POWER

POWER GENERATION,
NSMISSION, APPLICATION
THE ATTENDANT SERVICES
IN ALL INDUSTRIES

NOLOGY DEPT.

UGUST, 1942

t effective boiler capacity by inating wasteful use of proc- heat — sixth wartime special ion, page 99

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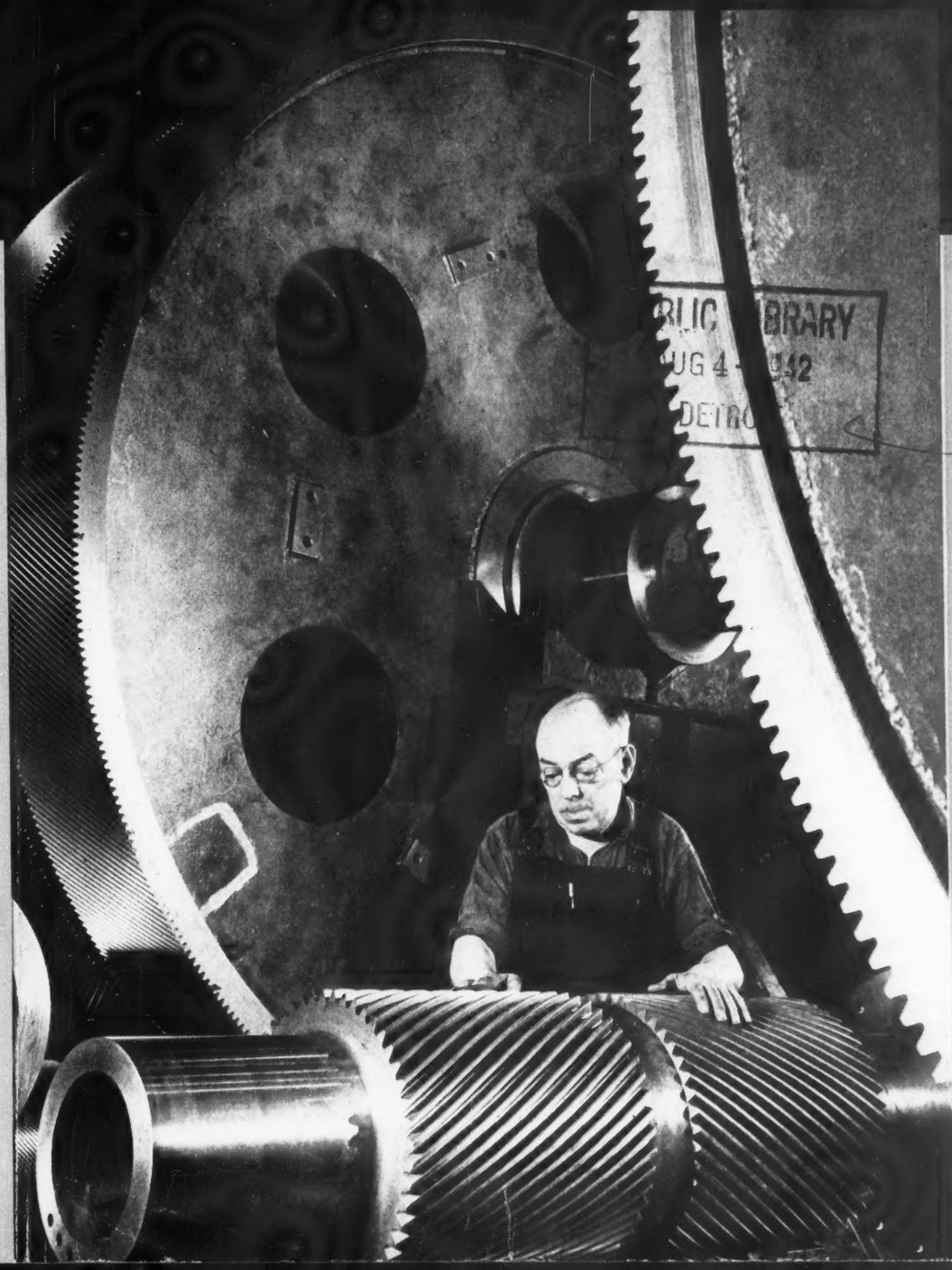
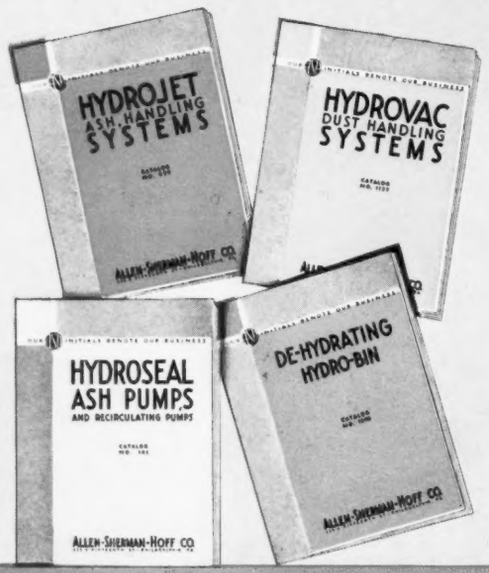


BLIC BRARY
UG 4 42
DETR

Ashes KNOCKED

Off Their Feet — *and Carried Out*



Size of the ash pile in the hopper means nothing to the Hydrojet System. The high velocity water directed by the Feed Nozzle undercuts the accumulated ashes, knocks down the pile and blasts clinker formation. The backwash carries the ashes into the sluiceway beneath the floor in proportion to the carrying capacity of the water, thus overloading is impossible. The Feed Nozzle can be directed to any part of the hopper area, thus it virtually becomes a water lance, with a capacity for moving approximately one ton of ashes per minute. Ashes are thus carried out directly to a permanent fill, temporary fill or dehydrating grab bucket sump. Alternately, the sluiceway delivers them to a small transfer sump, from which they are pumped by a Hydroseal Ash Pump to a dehydrating bin, permanent fill, temporary fill or a dehydrating sump.

ALLEN-SHERMAN-HOFF CO., 227 S. 15th St., PHILADELPHIA • *Offices & Representatives in Principal Cities*

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), August, 1942, Vol. 86, No. 8. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and Executive offices, 330 West 42nd Street, New York, N. Y. Entered as second class matter August 25, 1936, at Post Office, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42nd Street, New York, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions 36 shillings per year. All other countries $6.00 for one year, $9.00 for two years, 35c per copy.

GETTING "SOFT" ... EH?

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

"BEWARE of an America aroused!"

Sure we've been rolling on rubber—eating our sirloin steaks—lolling in the luxuries which only free Americans have the God-given genius to create, and the capacity to enjoy. But we can still take it, and we can still dish it out.

The world knows now that this "love of luxury" is just a thin outer garment, easily whipped off in an emergency—and that, underneath it, there are muscles of steel.

Sacrifice? We will sacrifice anything but our Liberty!

Suffering? We still remember about Valley Forge, and the blood of our fathers on the snow!

Death? Better death, any day, than life without freedom!

So they said we'd rather lose a war than lose an election? And those cracks, dividing us, were deep craters—not just surface scratches? Management wouldn't work with men, and men wouldn't work with management? And we couldn't get going *fast enough* to become a real factor in this war?

What a jolt the Axis is in for! You might just as well try to sweep the tide back with a broom as try to buck American machines, driven by free, skilled American workers.

◆ ◆ ◆

Inspired by the job our own workers are doing, we view this crisis, not with alarm—but with confidence. Every lathe, every drill, every tool in our plants has been turned into a weapon of war—every worker, man or woman, into a PRODUCTIONEER—a soldier in overalls. Such spirit, such skill, such strength cannot lose—for these men and women are fighting *with their hearts,* as well as with their heads and their hands—fighting, along with the millions of other patriotic workers throughout all America—to STAY FREE!

LINK-BELT COMPANY—INDIANAPOLIS—PHILADELPHIA—CHICAGO—ATLANTA—DALLAS—SAN FRANCISCO—CEDAR RAPIDS
THE LEAD NG MANUFACTURER OF EQUIPMENT FOR HANDLING MATERIALS AND TRANSMITTING POWER
Reprints in 4 colors furnished on request. Address: 307 N. Michigan Ave. Chicago.

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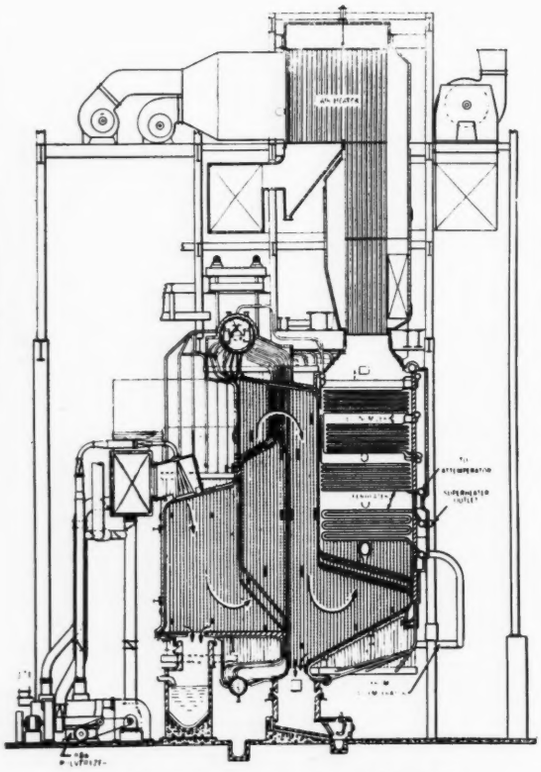
Not the number
-but the Job each



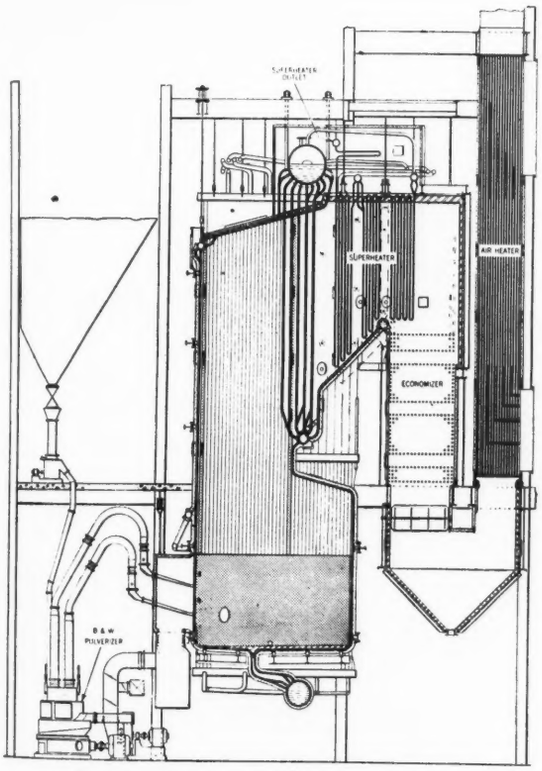
OPEN-PASS BOILER

B&W is naturally proud of the statistics covering the Radiant, Open-Pass, and Integral-Furnace Boilers sold in 1941 for central-station service, which, for example, show that 71 per cent were purchased by utility companies already having boilers of these designs in service or on order—definitely indicating the acceptance of these designs. Twelve of the boilers will have individual steam-generating capacities of 500,000 lb. per hr. and over, thirty-five are designed for pressures of 900 psi or higher, and thirty-two for total steam temperatures of 850 F. or above.

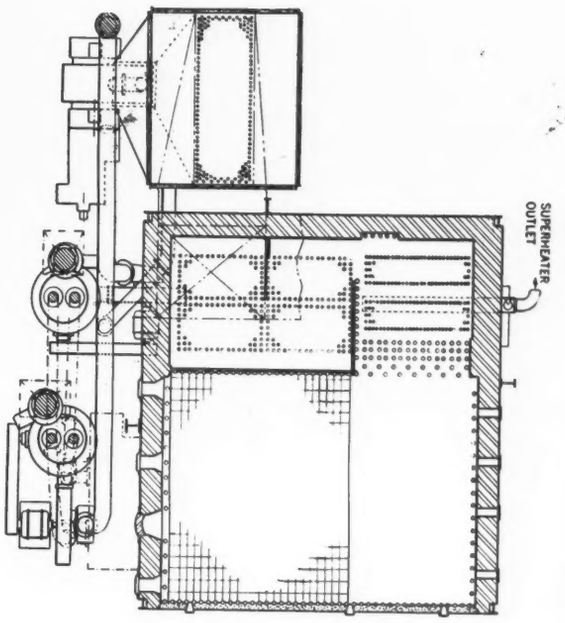
But greater pride is taken in the fact that each application is a pointed example of the adaptability of B&W designs to exacting central-station requirements, through the use of existing designs, the adaptation of an existing design, or the creation of a new design to meet specific engineering problems. And into each is built the broad experience of the B&W Company—experience impossible to write into specifications or to show on blueprints, but is inherent in all B&W Boilers.

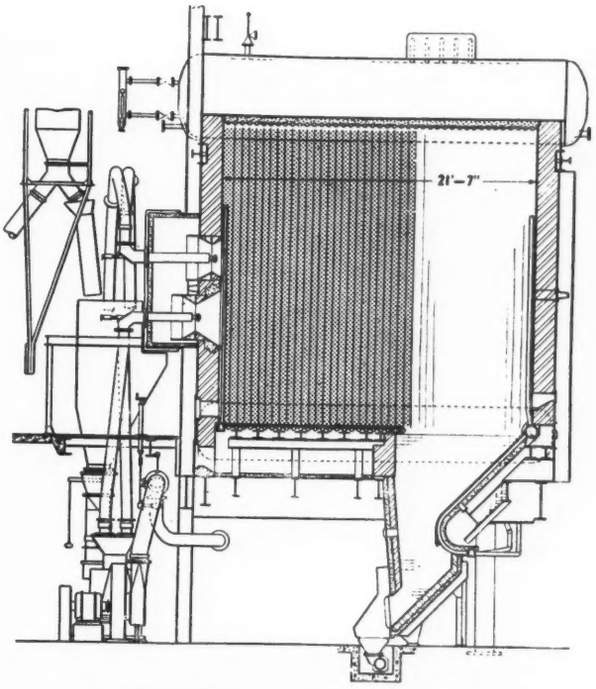
THE BABCOCK & WILCOX COMPANY
85 LIBERTY STREET, NEW YORK

r and size
h will do



RADIANT BOILER



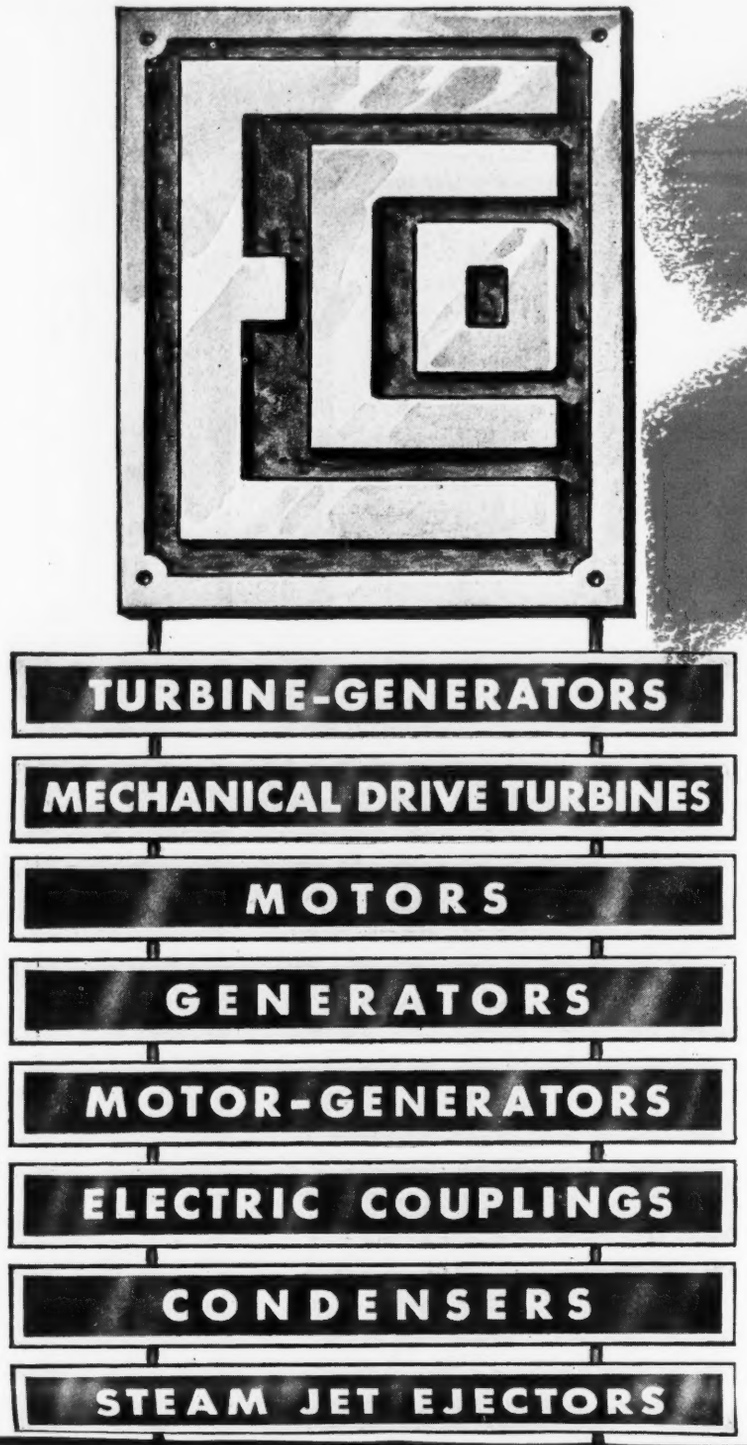


INTEGRAL-FURNACE BOILER

The Navy "E" Award to the Barberton Works for production achievement is "an honor not lightly bestowed and one to be cherished."

BABCOCK & WILCOX

G-217T



Service bars ...OF A VITAL WAR INDUSTRY

Look down this listing of Elliott products. Look *through* it, beyond it, to guns, tanks, planes, gun-powder, shells, steel, ships, all needed to insure the preservation of America. For that is what this listing represents.

Each of these bars stands for a successful campaign of engineering development whose fruits are now being turned against the Axis.

We believe that this war will be won by American Industry, developing a productive capacity totally unforeseen, particularly by the Axis powers. Signs of this development are already apparent. Here at Elliott Company we are working

STEAM JET EJECTORS

already apparent. Here at Elliott Company we are working

FEEDWATER HEATERS

DEAERATORS

CENTRIFUGAL BLOWERS

TURBOCHARGERS

DESUPERHEATERS

STRAINERS

SEPARATORS

GREASE EXTRACTORS

NON-RETURN VALVES

TUBE CLEANERS

on the basis that this productive capacity must be driven to its maximum at the earliest possible date, and that we can help by providing to the limit of our ability, the power equipment needed to turn the wheels of victorious production, as well as certain other equipment which utilizes that power.

Complete data on construction and application of the Elliott equipment here listed, is available at your specific request.

Q-1086

ELLIOTT COMPANY

JEANNETTE, PA. • RIDGWAY, PA.

SPRINGFIELD, OHIO

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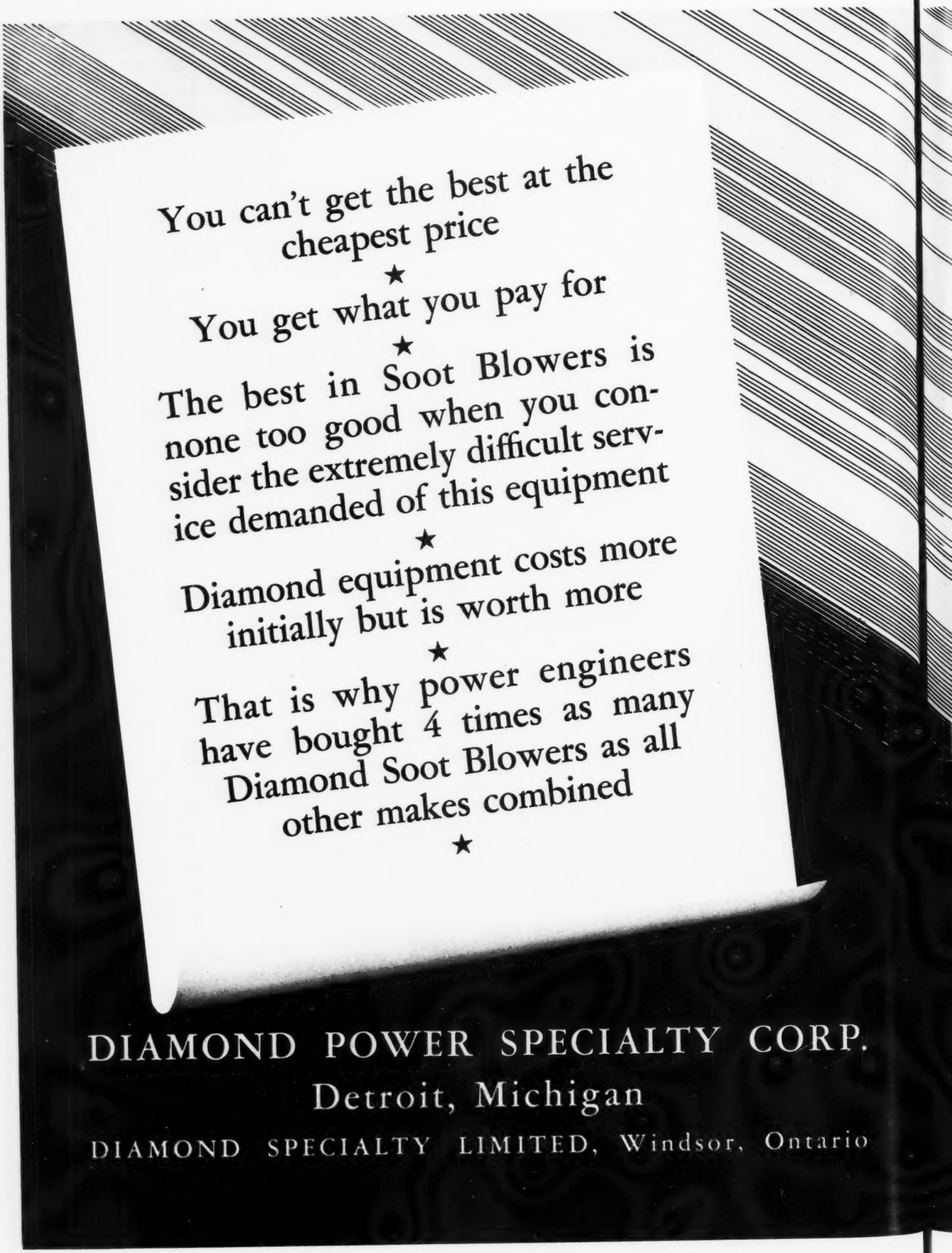
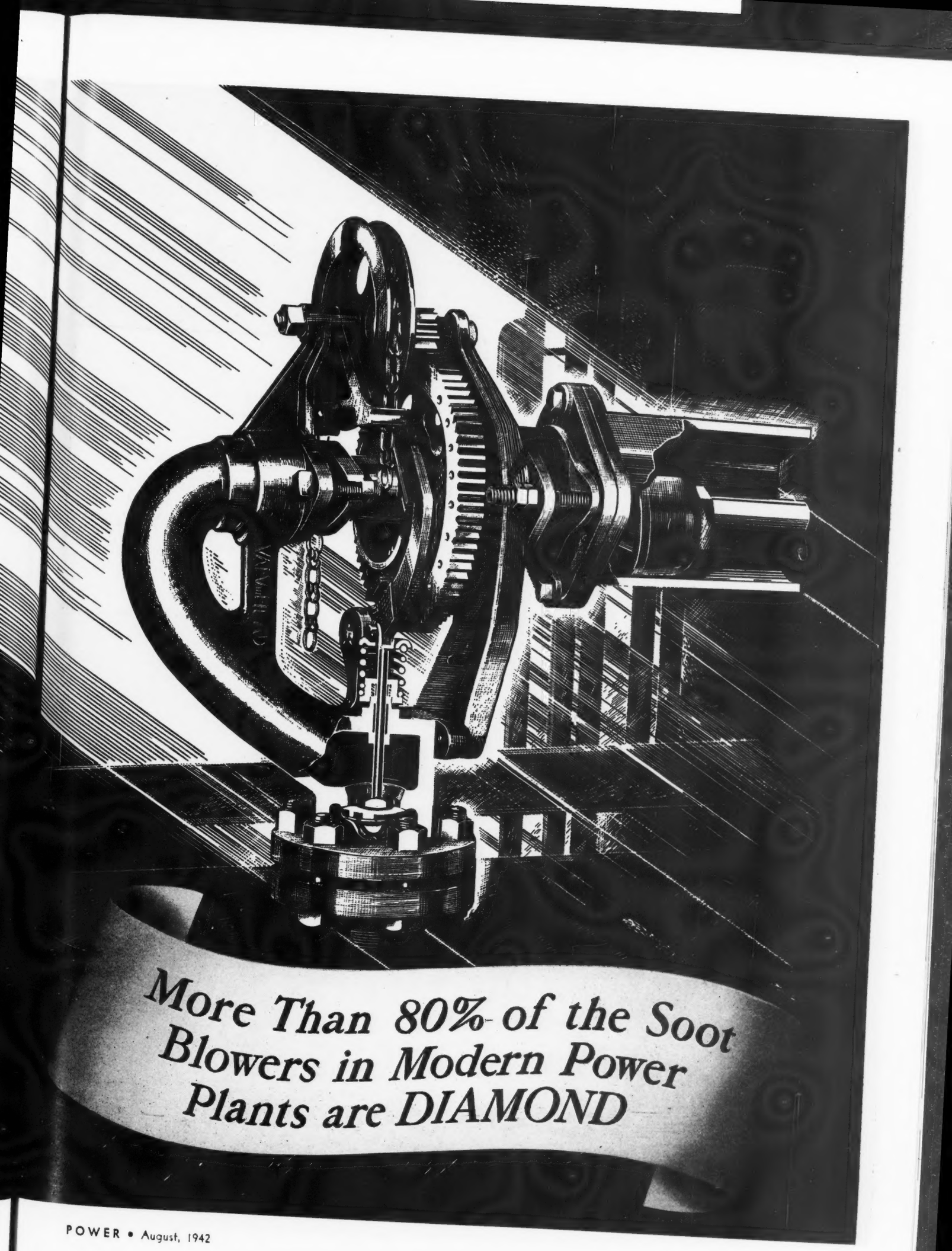
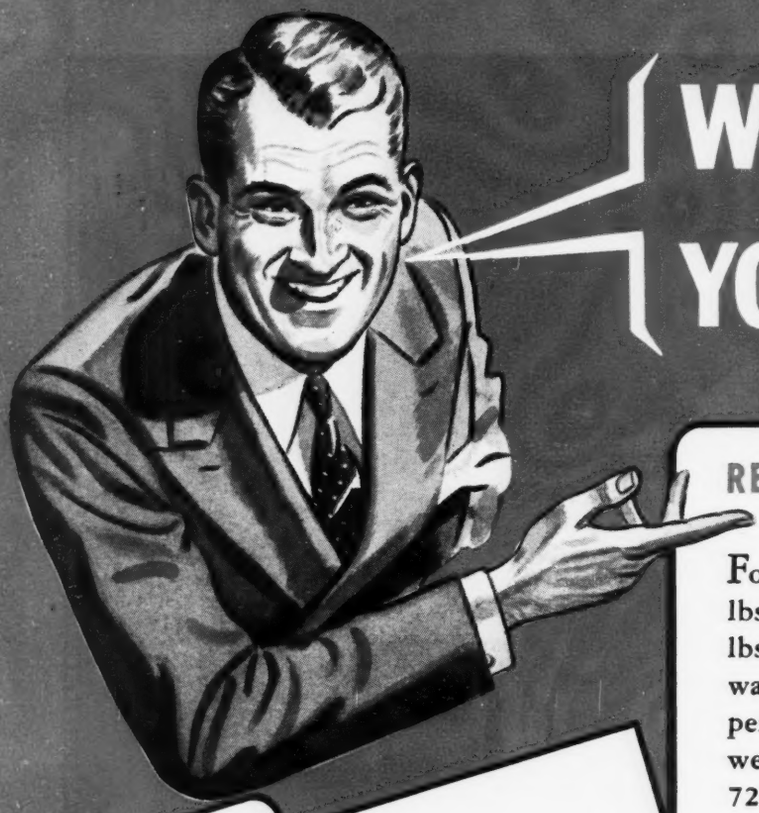

You can't get the best at the cheapest price
★
You get what you pay for
★
The best in Soot Blowers is none too good when you consider the extremely difficult service demanded of this equipment
★
Diamond equipment costs more initially but is worth more
★
That is why power engineers have bought 4 times as many Diamond Soot Blowers as all other makes combined
★
DIAMOND POWER SPECIALTY CORP.
Detroit, Michigan
DIAMOND SPECIALTY LIMITED, Windsor, Ontario


More Than 80% of the Soot
Blowers in Modern Power
Plants are DIAMOND



WHEN YOU WANT
YOU WANT A-E-CO

PROBLEM:

The selection of fuel firing equipment by a municipal electric light plant for a high pressure boiler supplying modern turbine generating equipment. Most important factor was reliability—together with equipment which would preclude any problem of flame stability and the need for auxiliary fuel at lower steaming rates.

SOLUTION:

A Taylor Hydraulic Ram-Driven Stoker was installed under a high pressure boiler of 100,000 lbs. per hour capacity. The furnace was equipped with A-E-CO inclined side water walls and rear waterwall.

RESULTS:

For the two-year period of 1940-1941, 593,070,000 lbs. of steam were generated, burning 54,326,000 lbs. of coal. The average evaporation for the period was 10.9 lbs. of steam per lb. of coal; average B.T.U. per lb. coal as fired 14,267. Operating conditions were: pressure 400 lbs. gauge; steam temperature 725°F.; temperature feed water to boiler 302°F. The combined efficiency of the unit was 84.4%, preheated air temperature to stoker 300 to 325°F.

CONCLUSIONS:

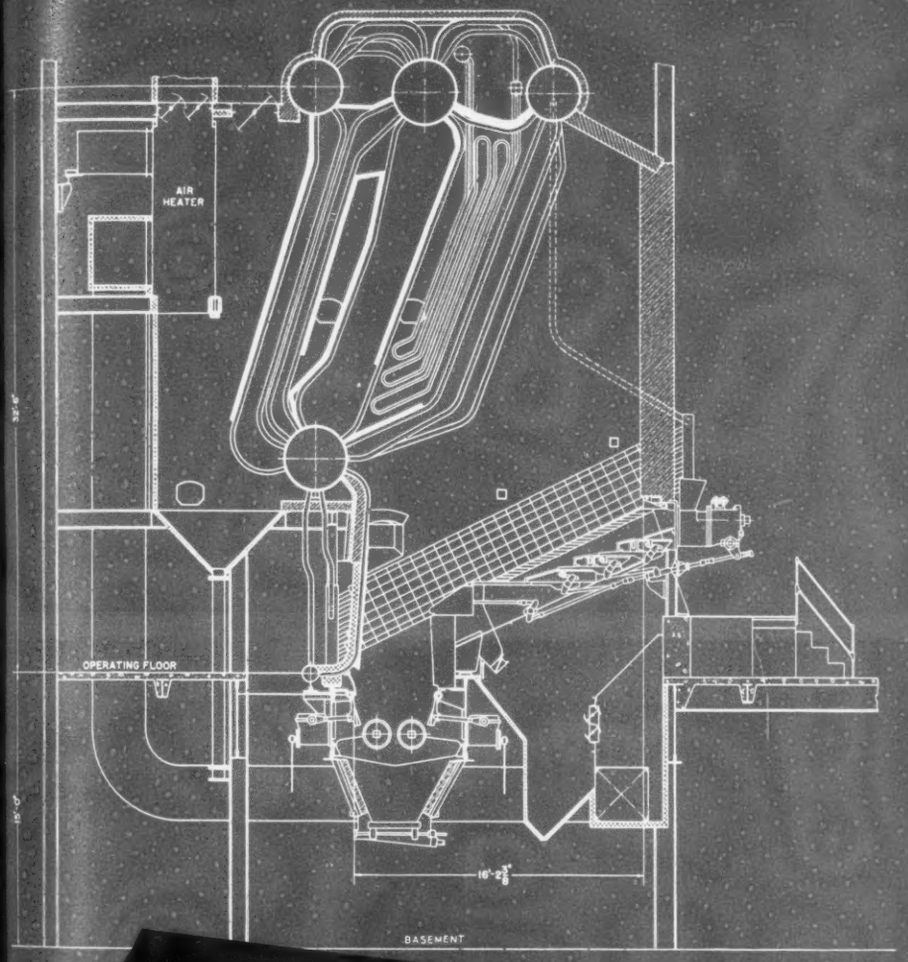
When considering reliability for a light plant load it is necessary to take into account the wide steaming range and the problems of flame stability and use of auxiliary fuel at light ratings. Choice of a Taylor Stoker eliminates all these factors. Ignition is no problem at light steaming loads and auxiliary fuel is not required regardless of the minimum load met.

A CASE IN THE MUNICIPAL PLANT FIELD

AMERICAN ENGINEERING

PHILADELPHIA • PENNSYLVANIA

THESE RESULTS TAYLOR STOKERS



A-E-CO TAYLOR STOKERS ON THE FIRING LINE

*Aluminum Company of America, Edgewater, N. J.
*Aluminum Company of America, New Kensington, Pa.
American Tobacco Co., Inc., Durham, N. C.
Castanea Paper Company, Johnsonburg, Penna.
Chrysler Corporation, DeSoto Plant, Detroit, Mich.
*Collins and Aikman Corp., Roxboro, N. C.
City of Columbus, Ohio
*Consolidated Paper Company, Monroe, Michigan
*Cresson State Sanitarium, Cresson, Penna.
Defiance Milk Products Co., Defiance, Ohio
*DeLaval Steam Turbine Co., Trenton, N. J.
*Detroit Sulphite Pulp & Paper Co., Detroit, Michigan
City of Dover, Ohio
*Draper Corporation, Hopedale, Mass.
Erwin Cotton Mills Co., West Durham, N. C.
*Fisher Body Corporation, Detroit, Michigan
Fisher Body Corporation, Fleetwood Plant, Michigan
*Fisher Body Corporation, Grand Rapids, Michigan
*Fisher Body Corporation, Pontiac, Michigan
Fox Paper Company, Lockland, Ohio
Froedtert Grain and Malting Co., Milwaukee, Wisc.
*City of Galion, Ohio
*Gardner-Richardson Company, Lockland, Ohio
*General Electric Company, Erie, Penna.
*General Electric Company, Fort Wayne, Ind.
*Greenwood Electric L. & W. Plant, Greenwood, Miss.
*Board Public Works, Hannibal, Mo.
Hill School, Pottstown, Penna.
*Hobart Mfg. Co., Troy, Ohio
*City of Holland, Michigan
*Hope Natural Gas Co., Cornwell Station, West Va.
Hudepohl Brewing Co., Cincinnati, Ohio
Industrial Cotton Mills, Rock Hill, S. C.
*City Water & Light Plant, Jonesboro, Ark.
Kohler Company, Kohler, Wisc.
Maryland State Penal Farm, Roxbury, Md.
*Maybury Sanitarium, Northville, Michigan
Michigan Carton Company, Battle Creek, Michigan
*Michigan State College, East Lansing, Mich.
Municipal Light Plant, Marshfield, Wisc.
*Pacific Mills, Lyman, S. C.
*Packard Motor Car Co., Detroit, Michigan
*Municipal Electric Plant, Painesville, Ohio
*Park Drop Forge, Cleveland, Ohio
*Pennsylvania Electric Co., Seward, Penna.
*Pennsylvania R. R. Co., Philadelphia, Penna.
*Picatinny Arsenal, Dover, N. J.
*Pittsburgh Plate Glass Co., Barberton, Ohio
Borough of Quakertown, Quakertown, Penna.
Raleigh Wyoming Mining Co., Glen Rogers, W. Va.
*Rhinelander Paper Company, Rhinelander, Wisc.
City of Richland Center, Wisconsin
*City of Richmond, Indiana
Sayles Biltmore Bleachery, Biltmore, N. C.
Scotten Dillon Company, Detroit, Michigan
Shelby Cotton Mills, Shelby, N. C.
Sloane-Blabon Corp., Philadelphia, Penna.
*Solvay Process Company, Detroit, Michigan
*St. Elizabeth's Hospital, Washington, D. C.
City of St. Bernard, Ohio
Swarthmore College, Swarthmore, Penna.
*Timken Roller Bearing Co., Canton, Ohio
Timken Roller Bearing Co., Gambrinus, Ohio
Municipal Water & Light Plant, Tippecanoe City, O.
City of Toledo, Ohio
*Union Bleachery, Greenville, S. C.
Union Mills Paper Mfg. Co., New Hope, Penna.
*University of Wisconsin, Madison, Wisc.
*Vassar College, Poughkeepsie, New York
*Borough of Vineland, New Jersey
Warfield Natural Gas Company, Harold, Kentucky
White Sewing Machine Co., Cleveland, Ohio
Whiting Plover Paper Company, Stevens Point, Wisc.

(*) *Represents repeat orders.*

A-E-CO TAYLOR STOKER

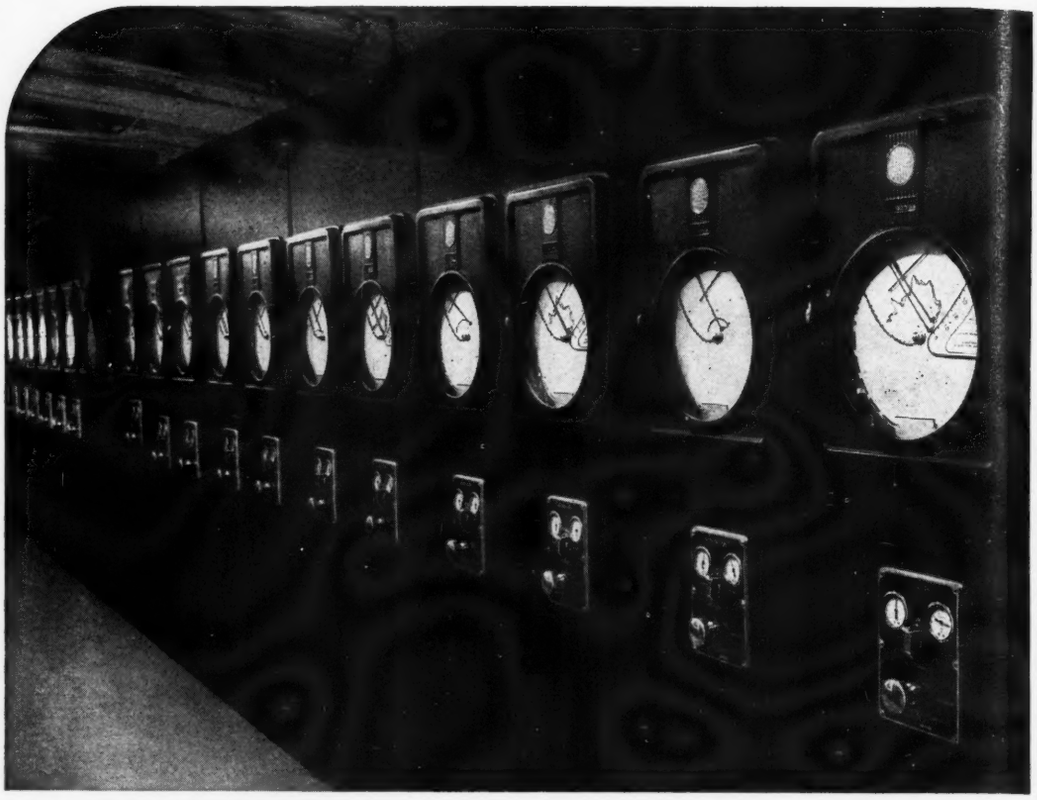
A-E-CO TAYLOR STOKERS
WATER WALLS · ASH HOPPERS
HELE-SHAW FLUID POWER
MARINE DECK AUXILIARIES
LO-HED HOISTS

COMPANY

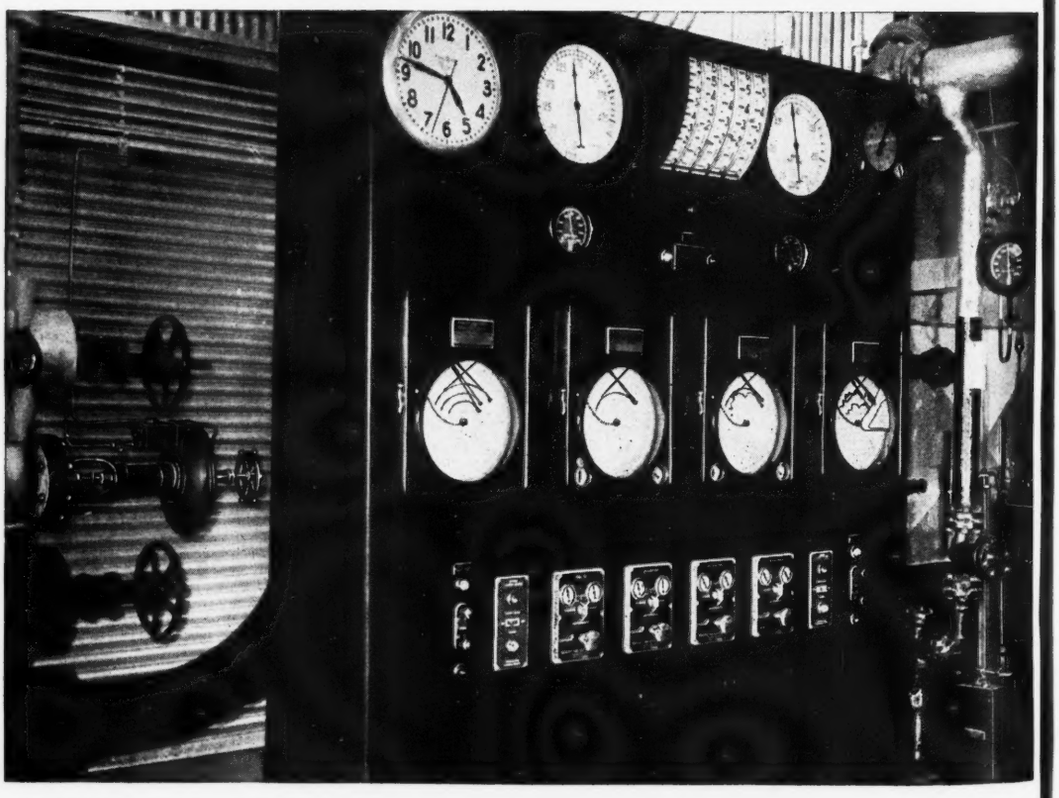
BEFORE YOU BUY ANY FUEL FIRING EQUIPMENT CONSIDER EACH OF THESE 12 FACTORS

1. **RELIABILITY**—the ability to operate with minimum outage and minimum standby equipment.
2. **CAPACITY**—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.
3. **MAINTENANCE**—the ability to operate continuously with minimum repair costs.
4. **FLEXIBILITY**—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.
5. **EFFICIENCY**—the proved **dollar** efficiency (**total** cost of steam production) as shown by actual performance in similar installations.
6. **OPERATION**—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.
7. **ADAPTABILITY**—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.
8. **FUEL FLEXIBILITY**—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.
9. **REFUSE DISPOSAL**—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.
10. **STACK DISCHARGE**—the practical elimination of "smoke nuisance" without special equipment.
11. **SPACE REQUIREMENTS**—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.
12. **OBSOLESCENCE**— the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

HELP FOR THE BATTLE



These Bailey Meters and Controls insure maximum steaming capacity, minimum "time out" for repairs; and most economical use of fuel in a steel mill and a chemical plant.



BAILEY METER CONTROL . . .

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHEAT

OF 168 HR. PRODUCTION

Production for victory under the 168-hour week will try the soul of many a power plant engineer.

Steaming capacity will have to be stretched to the limit. Shutdowns for maintenance will result in lost production. Certain fuels will not be available and all fuels will have to be used with economy. Trained men will become scarce.

Under these conditions we will have to make the most of what we have. To help power engineers win the battle of 168-hour steam production, Bailey Meter Company has published a bulletin, "How to Safely Stretch Steaming Capacity".

This bulletin makes numerous fundamental suggestions which can be carried out without the use of elaborate metering or control equipment. It also explains how the proper use of metering and control equipment:

1. Stretches steaming capacity.
2. Avoids frequent shutdowns for maintenance.
3. Insures safety of men and equipment.
4. Furnishes data for comparison of fuels.
5. Reduces consumption of fuel.
6. Maintains efficiency while training new operators.

These suggestions will help you win the battle of 168-hour production. Ask for Bulletin No. 16. It will be sent without obligation of any kind.

A-82

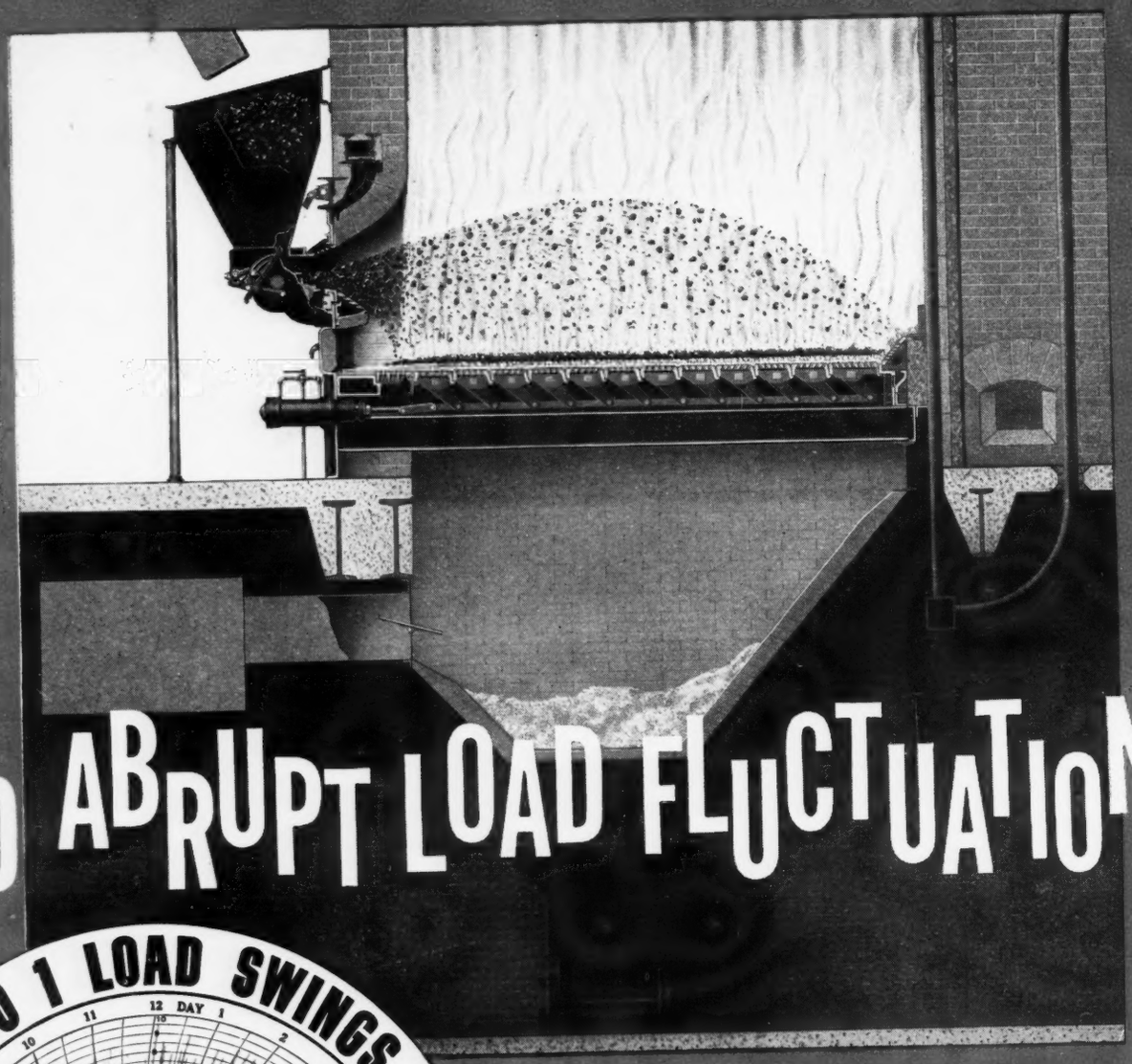
BAILEY METER COMPANY
1036 IVANHOE ROAD • CLEVELAND, OHIO
Bailey Meter Company Limited, Montreal, Canada

BAILEY METERS

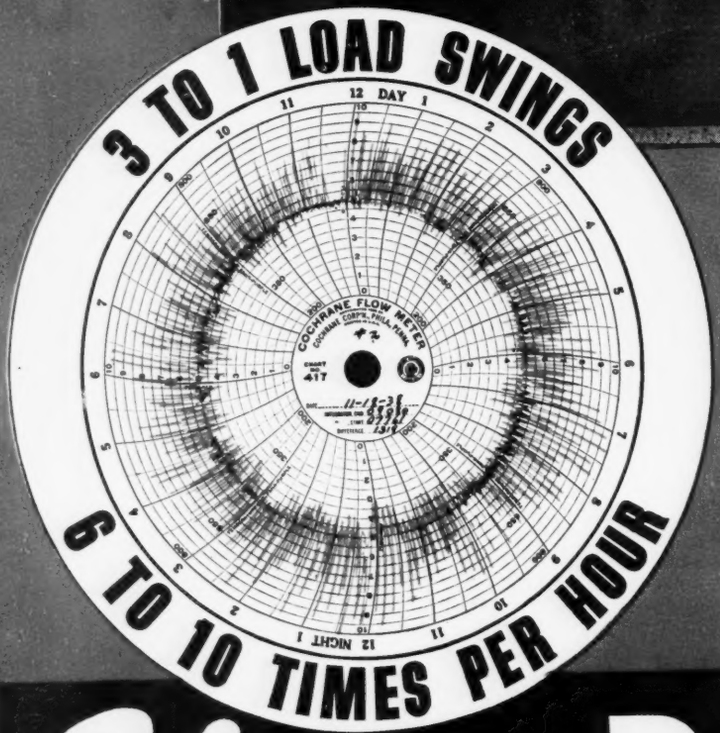
The Complete Combustion Control System

CONTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

FOR HIGHER CAPACITIES



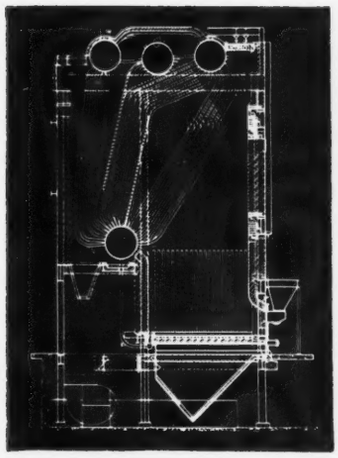
AND ABRUPT LOAD FLUCTUATIONS



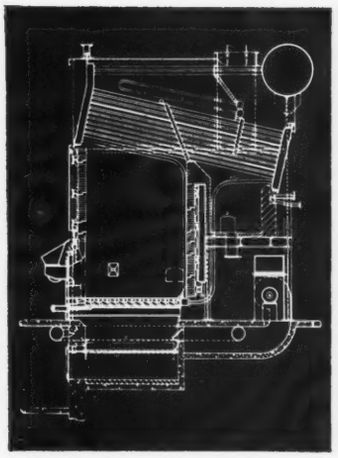
RotoStokers develop high capacities. Fluctuating loads are successfully handled because of rapid burning of the fuel with extra turbulence in the furnace. Coal feed and air supply are accurately controlled so that extreme fluctuations in load are carried by the unit, with uniform pressure maintained. • *Write for Bulletin No. 830.*

DETROIT STOKER COMPANY
Sales & Engineering Offices
General Motors Building • Detroit, Michigan

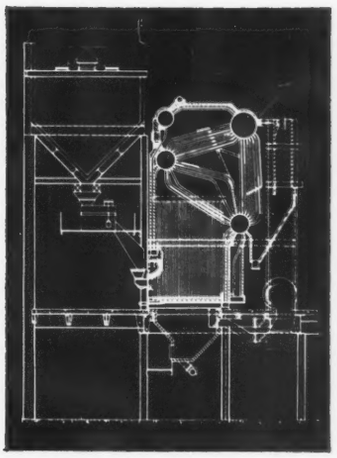
Use DETROIT



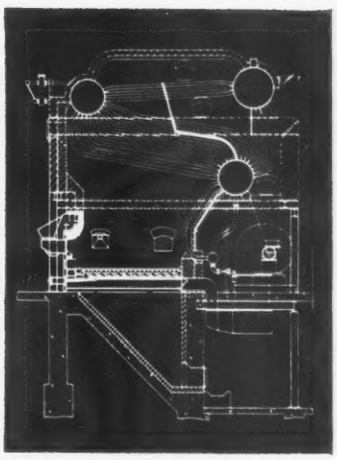
75,000 pounds steam per hour — Pennsylvania Coal.



30,000 pounds steam per hour—Southern Illinois Carbon Coal.



300% normal rating—West Virginia Coal.

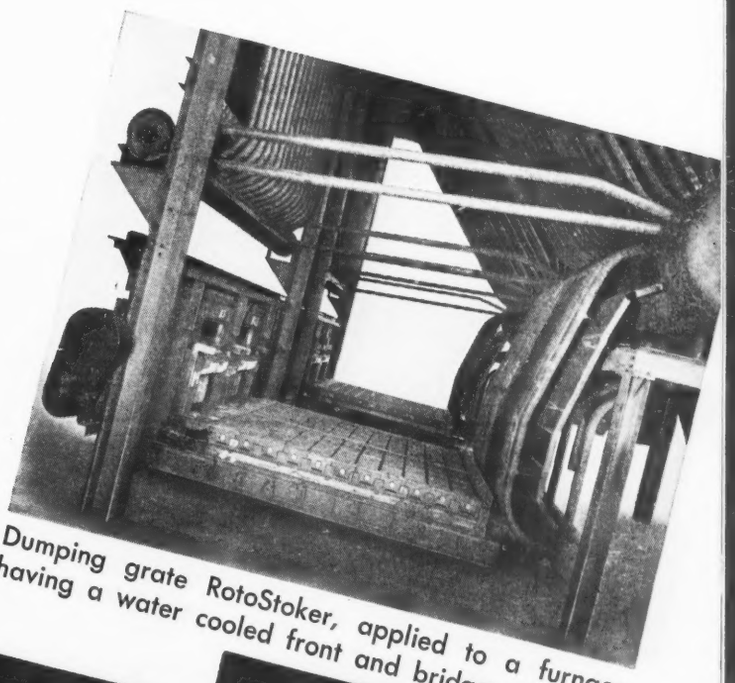


Iowa Municipal Plant — burns local Iowa screenings.

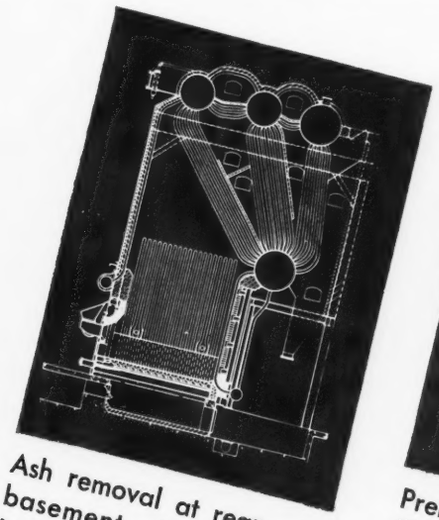
Burn a wide variety of fuels with a wide range of boiler types and sizes

ROTOSTOKERS OPERATE SUCCESSFULLY WITH:

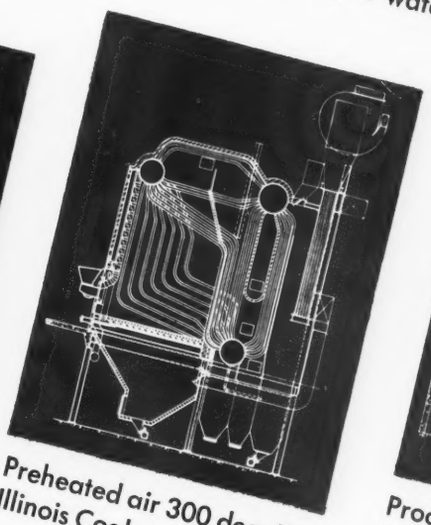
- *Uniform Fuel Distribution*
- *Thin, Porous Fuel Bed—No Agitation*
- *High Burning Rates with Fuels Having Ash of Low Fusing Temperature*



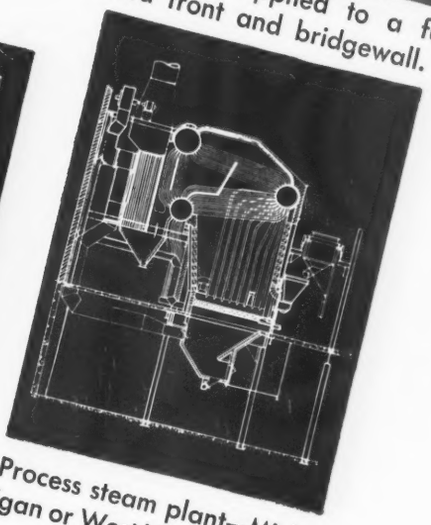
Dumping grate RotoStoker, applied to a furnace having a water cooled front and bridgewall.



Ash removal at rear — no basement — Eastern Kentucky Coal.



Preheated air 300 deg. F.— Illinois Coal.

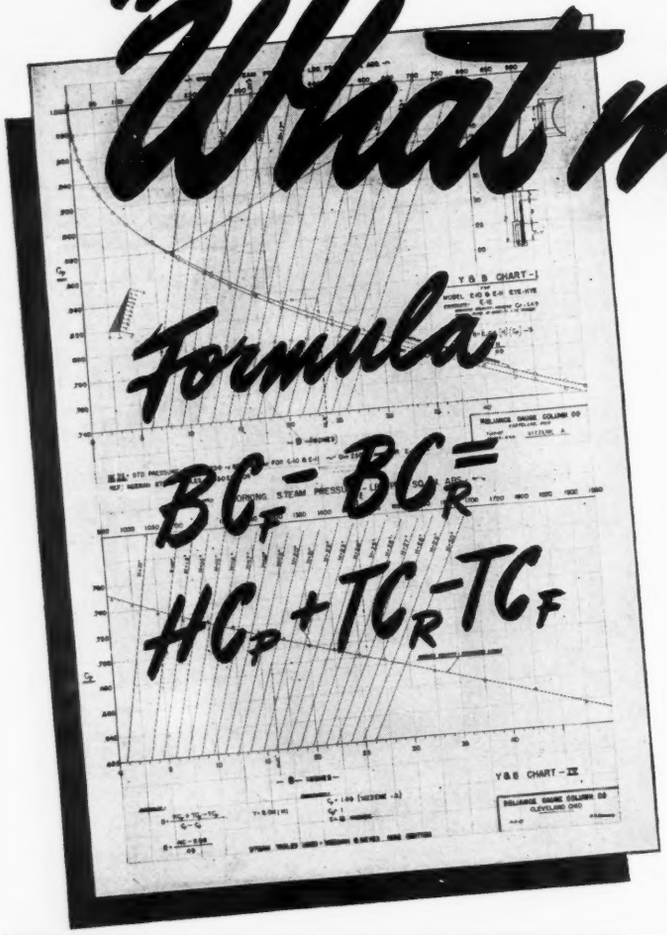


Process steam plant—Michigan or West Virginia Coal.

ROTOSTOKERS

Here's the Answer to

"What makes the

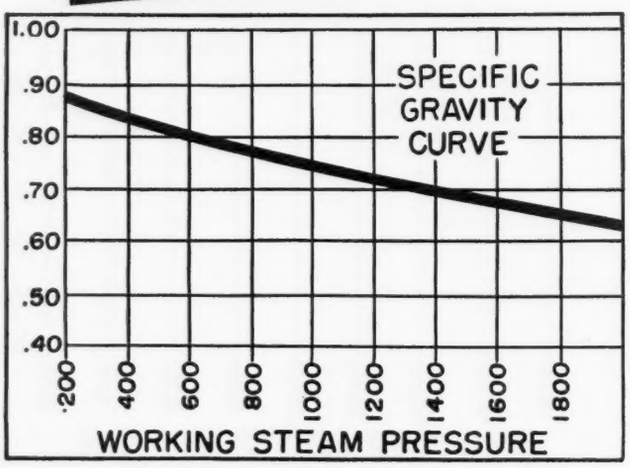


Why you can depend on the accuracy of this popular remote reading boiler water level indicator

YOUR CONFIDENCE in a device destined for continuous service on a vital job must be based on an assurance of its *dependability,* which in turn is insured by *simplicity of design and operation.* That, in one sentence, describes EYE-HYE. Let's prove it.

The basic U tube manometer principle uses hydrostatic pressures for actuation . . . no mechanical parts to wear, adjust or get out of order. Calibration is done at factory . . . nothing to be tampered with on the job.

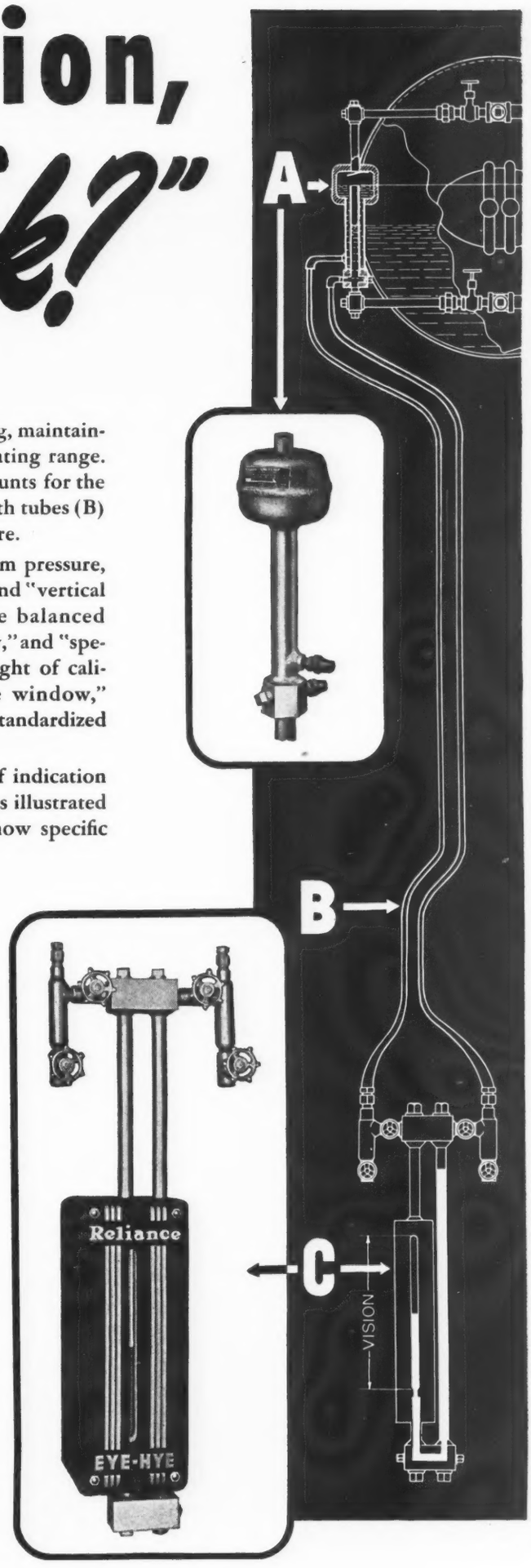
How does it work? A constant hydrostatic head is maintained on the left leg by condensation in the reservoir (A), which contains an overflow tube to return excess condensation to boiler drum. The level in the overflow tube is at all times that of the water in the drum, and overflow tube is connected to the right, or variable head, leg of the EYE-HYE. The actual difference of head pressure on the two legs is counterbalanced by the indicating fluid, "Vizzene," at the bottom of the U (window section of EYE-HYE). Calibration of the window section controls the rise and fall of Vizzene in direct proportion to the rise and fall of water in the drum.



THE RELIANCE GAUGE COLUMN COMPANY

Reliance

Your Question, EYE-HYE *Tick?*"



In the reservoir, one leg of water surrounds the other leg, maintaining the same temperature in both throughout the actuating range. This is highly important to accuracy of reading and accounts for the trade name "Unitemp Reservoir." Below the Unitemp, both tubes (B) and the HYE-HYE (C) are at the same, or room temperature.

Calibration must take into account the working steam pressure, interpreted into "specific gravity of boiler water," and "vertical boiler water level travel to be indicated," which are balanced against the "standard height of visible EYE-HYE window," and "specific gravity of Vizzene" to determine the "bore and height of calibrating tube." Other factors such as "bore of visible window," "safety tube height" and "bore of snubbers" remain standardized for given conditions.

A vital factor utilized to achieve absolute accuracy of indication is the *specific gravity* of the boiler water. Its importance is illustrated in the curve (graph on opposite page) which shows how specific gravity slumps in proportion to increase of steam pressure. This in turn alters the amount of head pressure, the actuating force of the EYE-HYE.

Vizzene indicating fluid is a stable bromine compound exclusively developed for use in the EYE-HYE. Dyed a brilliant green for perfect visibility, it is non-soluble in water, is unaffected by boiler water treatment. Available in several specific gravities for various operating conditions, and is always heavier than water to naturally prevent it from leaving the bottom of the U.

The EYE-HYE and the Unitemp Reservoir are fully covered by patents, and patents pending.

Easy to install, operate and maintain, EYE-HYE brings water level reading where you want it, at eye level. . . . Write today for Bulletin 382-C containing more complete information — and list of users.

5902 CARNEGIE AVE., CLEVELAND, O.

BOILER SAFETY DEVICES SINCE 1884

HOW HARD-FACING

saves Time, Power, and Materials

What Hard-Facing Is

Hard-facing is the process of welding on to wearing parts a coating, edge, or point of a hard metal —usually a special alloy possessing exceptional wear resistance. By this method, it is possible to protect metal surfaces that normally wear away rapidly in service. This process can be applied with equal advantage to new parts before they are used, or to worn parts.

Hard-Facing Increases Service Life

Hard-facing gives considerably longer life to wearing parts of many different kinds. Depending on the hard-facing rod used and the service to which the part is subjected, a hard-faced part will last from two to twenty-five times longer than a steel part that has not been protected by this method. Most parts can be hard-faced again and again.

Less Shutdown Time

As a result of the increased life of hard-faced parts, fewer shut-downs for replacements are necessary. This avoids lost time for both labor and equipment. In addition, problems of obtaining replacement parts are often completely eliminated.

Less Steel Waste

Many parts that would otherwise have to be sent to the scrap pile can be salvaged by hard-facing and quickly put back into service at a cost considerably less than that of replacement with new stock. And since such salvaged parts usually can be hard-faced repeatedly, it is possible to reduce the stock of reserve parts.

Lower Power Consumption

Parts that are used to cut, scrape, or drill stay sharp longer when they are hard-faced. This reduces power consumption, and helps maintain a uniformly high overall efficiency.

Substitute Base Metals

Substitute base metals that are more readily available than special steels can often be used in the fabrication of parts if hard-facing is employed. The metal can be selected for core properties without regard to wear resistance, and wearing surfaces can then be protected by the welded-on hard-facing deposit.

Haynes Stellite Rods

Haynes Stellite Company has a hard-facing material for every type of application. Whenever abrasion, heat, or corrosion takes its toll, there is a Haynes Stellite rod to provide lasting protection. *Write to any district office for a copy of the informative booklet, "Hard-Facing Materials Data".*

HAYNES STELLITE TRADE MARK

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York, N. Y. UCC Kokomo, Ind.

Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

HARD-FACING RODS FOR EVERY PURPOSE

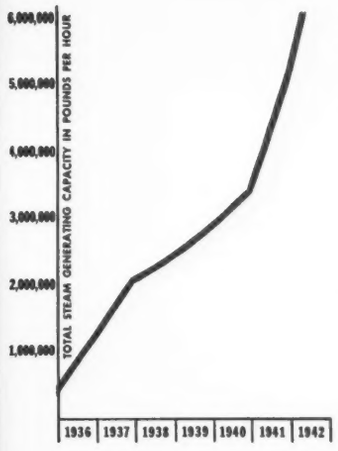
"Haynes Stellite" is a registered trade-mark of Haynes Stellite Company.

WATER-COOLED STOKER SERVICE —NO MILITARY SECRET!

WATER-COOLED STOKER PICKED for RELIABILITY

Reliability was the Number 1 requirement for fuel burning equipment under consideration by an eastern central station. Greater assurance of reliability was forecast by Taylor Water-Cooled Stokers. Accordingly, the station purchased a 6-retort, 25-tuyere Taylor Water-Cooled Stoker for application to a 695 H.P. Boiler. The water-cooling elements of the stoker were extended up the front wall to provide economical cooling of the front wall.

Follow the Rise of Water-Cooled Stoker Sales



This chart tells you at a glance how power plant operators feel about the Taylor Water-Cooled Stokers. Many of the reasons for their enthusiasm are found in Catalog W, offered below. Why not send for it?

Read the Record

Stoker....Six-retort Taylor Water-Cooled 25QC9W...	Turbine Driven
Boiler....6,952 sq. ft.	Rear Water Wall
Date Unit went into service	May 2, 1940
Coal burned since starting date	16,926,144 lbs.
Water evaporated since starting date	187,956,000 lbs.
Average actual evaporation	11.10 lbs.
Average operating steam pressure	170 lbs.
Average operating steam temperature	375°F.
Average operating CO_2 at 35,000 lbs. per hr.	13.8%
Average flue gas temperature at 35,000 lbs. per hr...	500°F.
Average overall efficiency since starting up	82.1%
Number of times and total hours unit was taken out of Service as a result of stoker and stoker water-cooling system, inspection, cleaning and maintenance	4 times total of 8 days
Availability factor	97.7%
Load characteristics	Gradual variations of 10,000 lbs. to 48,000 lbs. with average of 22,400 lbs.
Maximum load carried for 4-hr. periods	48,000 lbs.
Coal	Island Creek, Logan County, W. Va. (Mine No. 22)
Material cost for stoker maintenance	None

Coal Analysis

Volatile matter	34.50%
Fixed carbon	57.00%
Ash	6.00%
Moisture	2.50%
Sulphur	0.45%
B.T.U. (as fired)	13,800
Ash fusing temperature	2,480°F.

Read What a User Has to Say

"Our experience on two 40,000 pounds steam per hour water-cooled stoker units for over three years has shown that—

"Maintenance cost is lower . . . Reliability and freedom from breakdown is thus far more favorable . . . No tuyeres have been replaced as yet. Capacity or load demands have been rapidly met from minimum to maximum loads covered in the design.

"The flexibility of the water-cooled stoker has enabled us to successfully burn a very wide range of coals varying from the low through the high volatile range (17 volatile to 38 volatile). Consequently we can economically purchase our coal on a strictly B.T.U. basis, regardless of Ash Fusion Temperatures."

You Need All 3

Of the many ways Taylor Water-Cooled Stokers improve operation, three predominate: 1. Increased reliability. 2. Increased fuel flexibility. 3. Higher operating efficiency.

For an explanation of these advantages write for your copy of Catalog W. It contains useful information. Send in the coupon.

A-E-CO TAYLOR WATER-COOLED STOKER

A-E-CO TAYLOR STOKER Water Cooled

AMERICAN ENGINEERING COMPANY
2400 Aramingo Avenue, Phila., Pa.

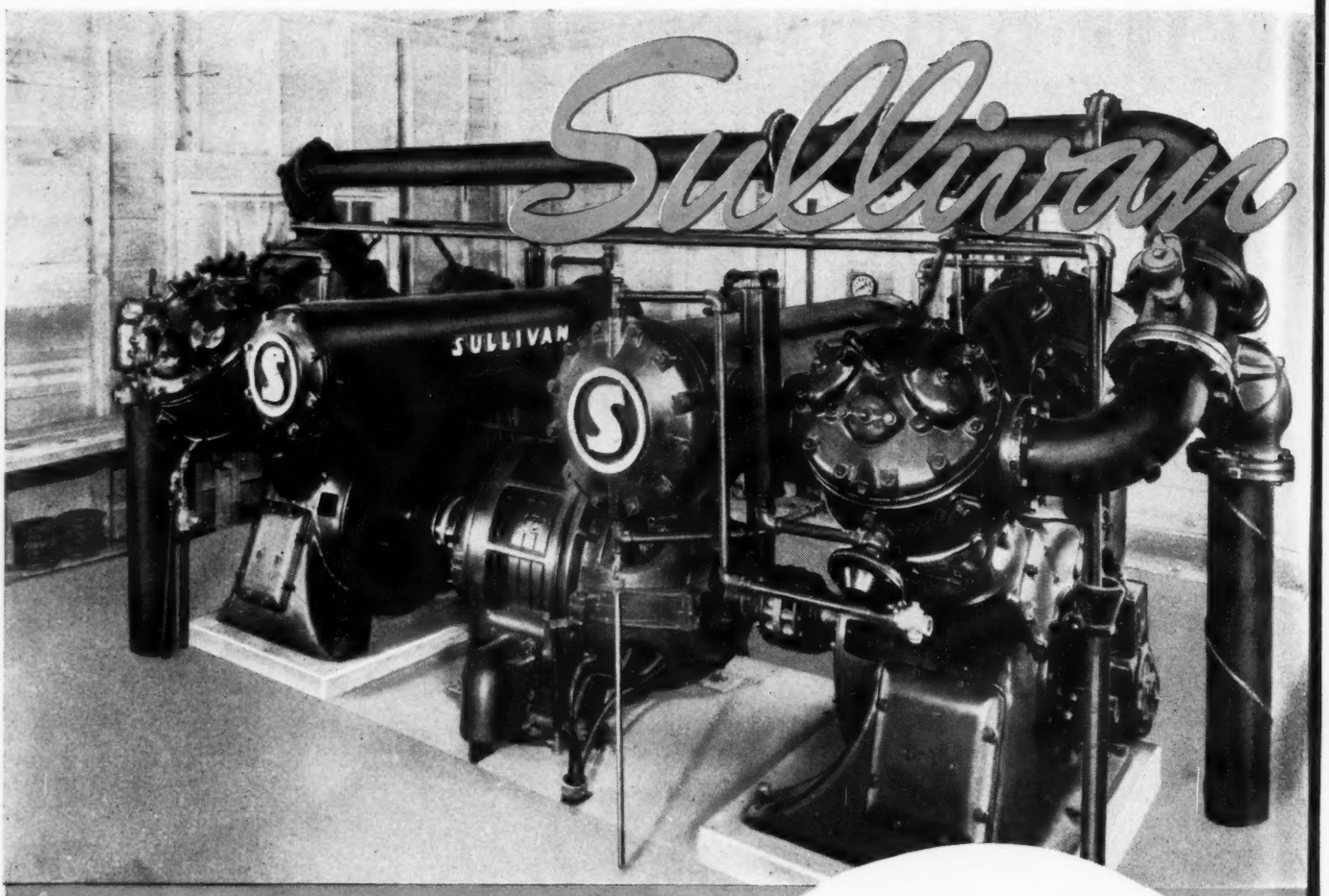
Send me without obligation a copy of the 8-page Catalog W describing Taylor Water-Cooled Stokers.

*Name*_____

*Company Name*_____

*Address*_____

*City*_____ *State*_____

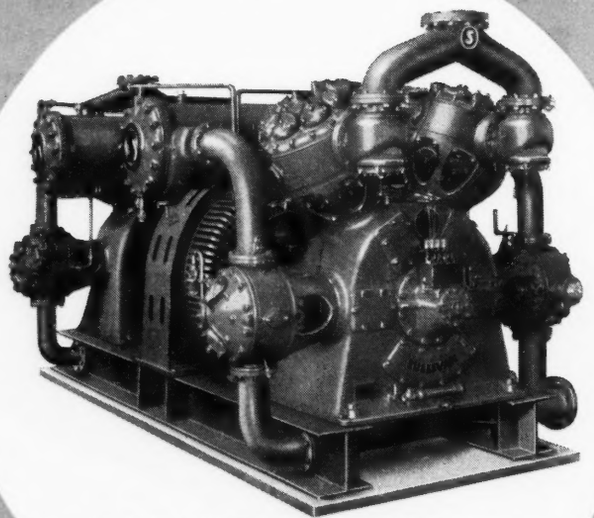


Twin installation of two Sullivan WN-112 Package Type Compressors and synchronous motor. Gives flexibility for all load conditions and standby insurance.

TEN GOOD RULES for Air Compressor Lubrication

1. Double acting compressor cylinders should be lubricated by means of *visible flow* force-feed lubricators.
2. Highest quality air-cylinder oil should be used in adequate but not excessive quantities.
3. Determine proper amount of lubrication by examination of the compressor valves. All parts should have a definite oil film thereon. If they feel dry the lubrication is inadequate. If the oil film is too heavy, or if excessive carbon deposits are evident, lubrication is excessive.
4. Crankcase oil-sump should have an external oil-level indicator. If force-feed lubrication is used, should also have a pressure gauge in the system to indicate oil pressure.
5. Crankcase oil should be maintained at proper level and periodically replaced by a good lubricating oil.
6. Thoroughly clean all sludge and old oil from crankcase oil-sump when changing to new oil.
7. Obtain definite recommendations from reputable refiners as to proper type and viscosity of oil for both crankcase and air-cylinder lubrication.
8. Prevent contamination of oil in storage by keeping it tightly covered and avoiding contact with harmful substances and dirty containers.
9. Inspect and regularly clean all screens and filters in the lubricating system.
10. Periodically check, while in operation, the oil pressure, rate of cylinder lubrication and any other external indicators of proper lubrication.

Watch for the next Sullivan Advertisement for 10 Good Rules for Safe Compressor Operation.



A Twin Installation of two WN-114 Package Type Compressors in a great steel mill. Compressors run in tandem or singly, operate at peak efficiency and conserve power.

SULLIVAN

SULLIVAN Products SPEED PRODUCTION to VICTORY

PACKAGE TYPE *AIR* COMPRESSORS

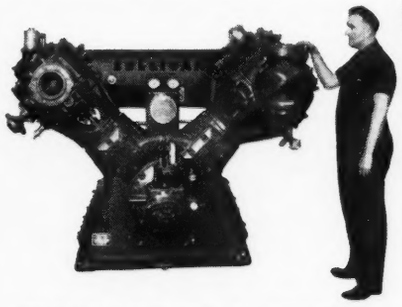
Twin Compressor Units

Flexible, Economical and Efficient Means of Meeting Widely Varying Air Demands

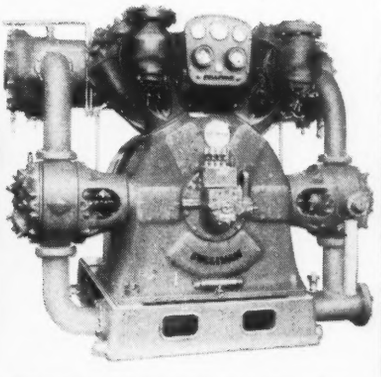
FOR utmost efficiency in meeting widely varying air demands, investigate the flexible, economical and compact Sullivan Twin Air Compressor Units. A Twin Compressor Unit consists of two Sullivan "Package Type" Compressors driven by a single synchronous motor or turbine speed reducer set with a double-ended shaft. Each compressor is easily connected or disconnected by means of a flexible coupling. Thus, during periods of peak demand, you can operate both compressors. During periods of lesser demand, you simply disconnect one compressor.

Plants anticipating future expansion or requiring above-normal power-factor-corrective KVA can purchase one half a Twin Unit now and add the second half when increased demand warrants it.

Sullivan Package Type Compressors are extremely compact when used in twin combinations. The unit requires only a simple concrete foundation. The economy of a single prime mover is obvious. The twin compressor idea, pioneered by Sullivan 20 years ago, is especially advantageous now when every possible economy must be practiced and efficiency maintained at a peak . . . when America's factories are her battle line and must stand unyieldingly in place. Sullivan Compressors are built by workers every one of whom knows how much depends on their unfailing performance.



WN-112 Two Cylinder Package Type Compressor, 378 to 1828 C. F. M. Maximum space requirements: 8 feet long, 6 feet 8 inches wide; foundation 4 feet 2 inches long; 2 feet 11 inches wide.

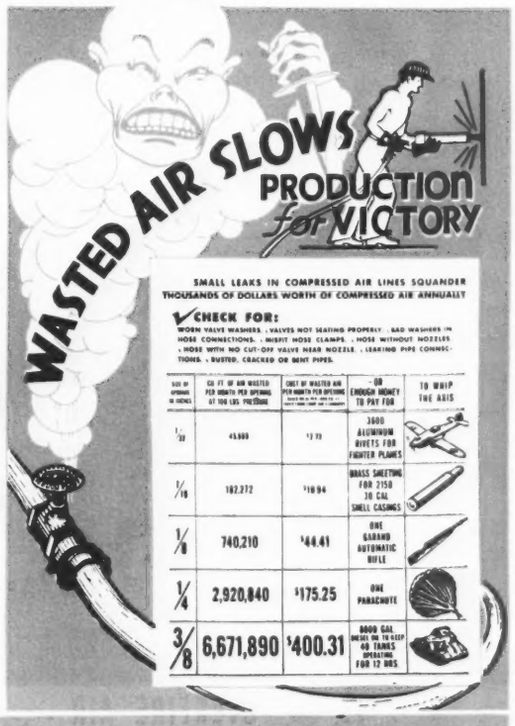


WN-114 Four Cylinder Package Type Compressor made in 4 sizes, in single and twin units. 175 to 600 h.p. 1092 to 3656 C.F.M. Floor space 9 feet x 10 feet. Foundation 5 feet x 8 feet.

Sullivan PACKAGE TYPE COMPRESSORS

are two-stage, double acting, long-lived, heavy duty, continuous service compressors—much smaller than old style compressors of the same capacity—and yet have operating economies equal to or exceeding those of the older bulky units of the same capacity. Package Type Compressors need only to be hooked up to power, water and air lines and they are ready for 24-hour per day constant and efficient service. They are particularly suitable for synchronous motor drive and extremely well adapted for drive from steam turbines or diesel engines.

FREE! Write for reprints of this chart in Poster form . . . printed in red, white and blue, 18 x 24 to hang in your plant.


WASTED AIR SLOWS PRODUCTION for VICTORY
SMALL LEAKS IN COMPRESSED AIR LINES SQUANDER THOUSANDS OF DOLLARS WORTH OF COMPRESSED AIR ANNUALLY
CHECK FOR:
WORN VALVE WASHERS . VALVES NOT SEATING PROPERLY . BAD WASHERS IN HOSE CONNECTIONS . MISFIT HOSE CLAMPS . HOSE WITHOUT NOZZLES . HOSE WITH NO CUT-OFF VALVE NEAR NOZZLE . LEAKING PIPE CONNECTIONS . RUSTED, CRACKED OR BENT PIPES.
SIZE OF OPENING IN INCHES
CU. FT. OF AIR WASTED PER MONTH PER OPENING AT 100 LBS. PRESSURE
COST OF WASTED AIR PER MONTH PER OPENING
OR ENOUGH MONEY TO PAY FOR
TO WHIP THE AXIS
1/32
43,800
$3.72
3600 ALUMINUM RIVETS FOR FIGHTER PLANES
1/16
182,272
$15.94
BRASS SHEETING FOR 2150 30 CAL SHELL CASINGS
1/8
740,210
$44.41
ONE GARAND AUTOMATIC RIFLE
1/4
2,920,840
$175.25
ONE PARACHUTE
3/8
6,671,890
$400.31
8000 GAL. DIESEL OIL TO KEEP 40 TANKS OPERATING FOR 12 HRS.

SULLIVAN MACHINERY COMPANY *Executive Offices: MICHIGAN CITY, INDIANA*

FACTORIES: MICHIGAN CITY, IND. • CLAREMONT, N. H. • DUNDAS, ONT. • GRANTHAM, ENG.

***Associated House:* Canadian Sullivan Machinery Company, Ltd., Dundas, Ontario**

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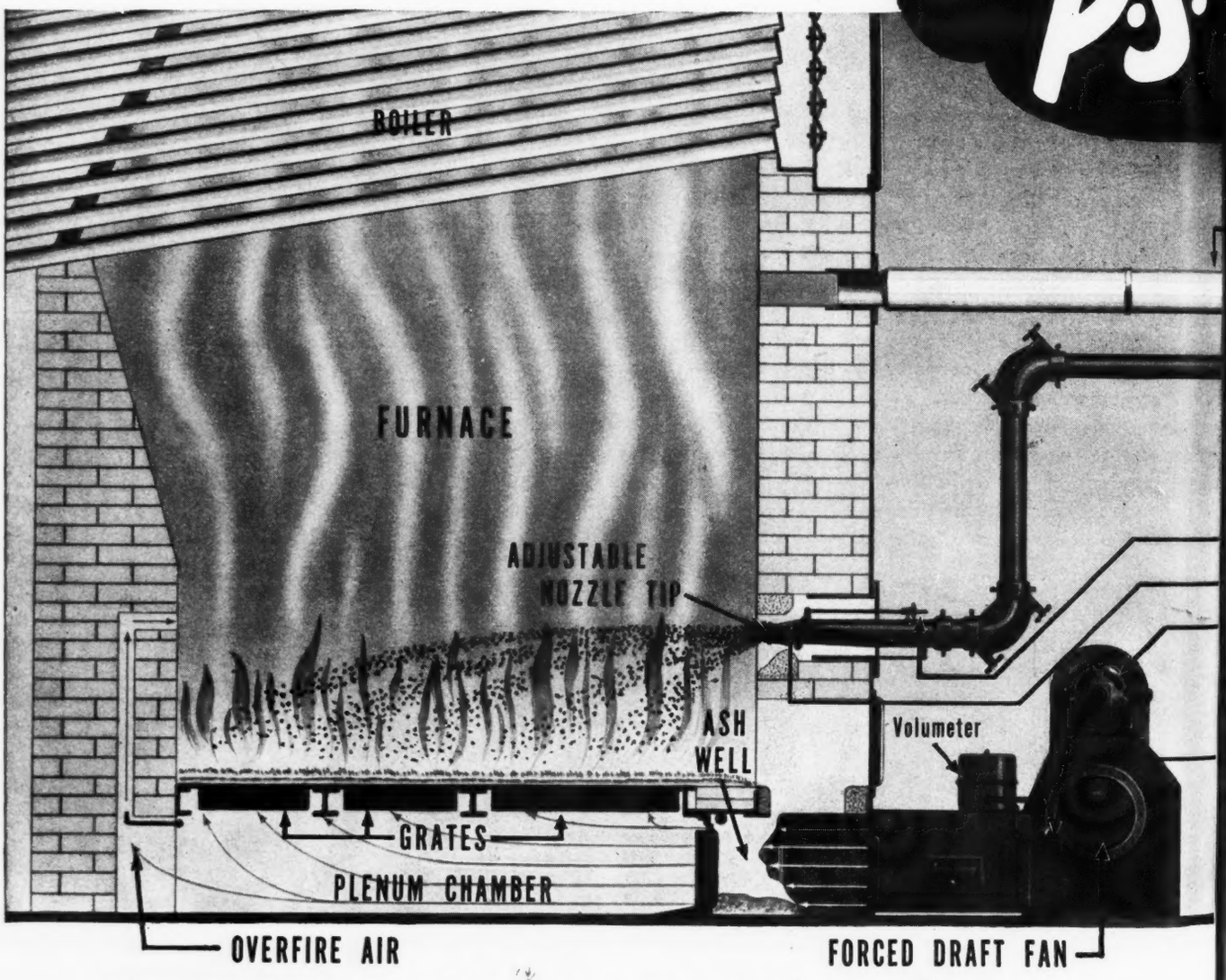
PRODUCTS

HEAVY DUTY, SINGLE OR TWO STAGE STATIONARY AIR COMPRESSORS IN ANGLE, V-VERTICAL, VERTICAL OR HORIZONTAL TYPES IN SIZES FROM ½ TO 3000 H. P. ALSO A COMPLETE LINE OF PORTABLE COMPRESSORS

Fastest Growing Type of

AMERICA'S power plant engineers immediately recognized, when it was announced nearly a decade ago, the important engineering advance embodied in the Pneumatic Spreader principle. Year after year, Iron Fireman Pneumatic Spreader stoker firing has been the fastest growing type of firing in U. S. industry. Today, Iron Fireman Pneumatic Spreaders are making an important contribution to the war effort by stepping up steam output of typical boiler plants *10% to 35%*, and at the

IRON P.S.



How the P. S. Stoker Achieves Its Remarkable Results

AS shown in the illustration above, the Iron Fireman Pneumatic Spreader conveys steam size coal from the hopper or main coal bunker to a transfer housing, where the coal is picked up by a stream of air and conveyed to the furnace and grates. The fines burn in suspension, utilizing the conveying air for combustion. The larger pieces form a shallow fuel bed on the grate. By means of an adjustable nozzle, the coal is dropped by gravity and *distributed uniformly over the entire surface of the grates.*

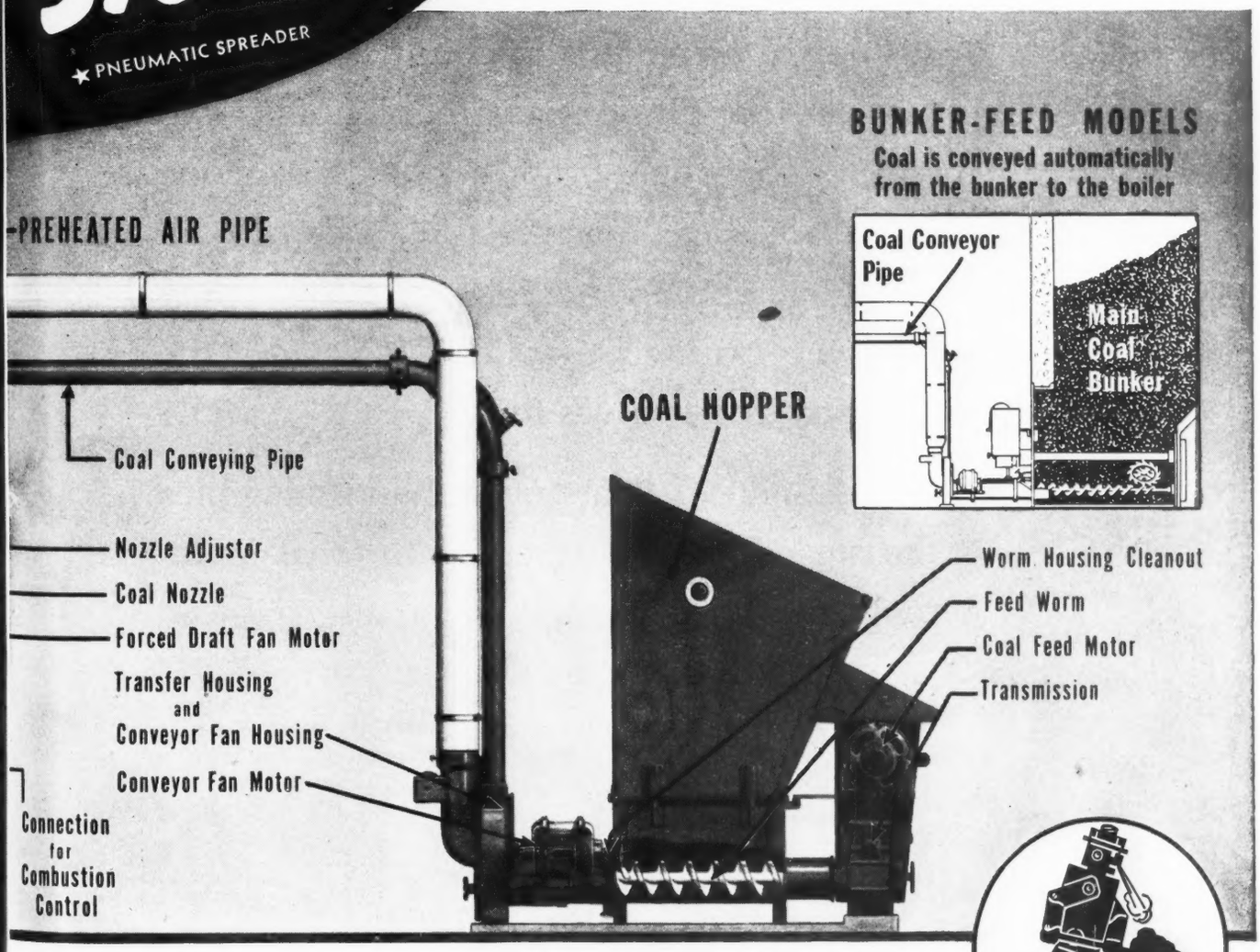
The conveying air provides the overfire air which is, of course, a requisite of efficient combustion. This air is more intimately mixed with the coal than is possible by any other means. Entering at right angles to the flow of undergrate air through the fuel bed, the conveying air produces *maximum turbulence; another requisite of efficient and smokeless combustion.*

Firing in U.S. Industry

FIREMAN STOKER

★ PNEUMATIC SPREADER

same time cutting fuel costs. Automatic firing and coal handling gives boiler room employees more time for productive work. There are definite reasons for this wholehearted acceptance of a new firing principle in the boiler plants of many of America's greatest industries. You owe it to yourself to become fully posted on this significant development in the science of firing.



Applications are flexible; the stoker can be set at boiler room floor level, or on the floor above or below. It can be located at any angle in front of the boiler, and at distances of 30 feet or more from the boiler front.

The Iron Fireman Pneumatic Spreader stoker was designed to burn efficiently a wide range of such economical fuels as the lower grade bituminous coals and also sub-bituminous and lignite coals, and to provide *a reliability of operation, physical adaptability, ease of operation,* and *low maintenance* not afforded by other types of automatic coal burning systems.

FREE BOOK on Pneumatic Spreader Firing

Contains full descriptions, capacities, operating data, etc., with layouts and photos of 10 actual installations. Sent free, on request. Write to Iron Fireman Mfg. Co., 3308 West 106th Street, Cleveland, Ohio.

THEY'RE TOUGH . . .
THESE 125 lb.

And they're proving it in countless plants in all industries. The extra strength built into these tough bronze valves comes in good stead in meeting the severe demands of continuous operation. Now more than ever they are proving to their users that it pays in the end to buy good valves first.

Figs. 2125 and 2129 are outstanding examples of the ruggedness and dependability that are inherent qualities in all Lunkenheimer products.

Your Lunkenheimer distributor has a supply. Ask for your copy.

Since virtually all materials used in the manufacture of valves are on the list of critical materials, valve users are urged to furnish the highest possible preference ratings and proper "end use" Allocation Classification Symbols on their orders. This will be of mutual helpfulness.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI, OHIO. U. S. A.

NEW YORK CHICAGO
BOSTON PHILADELPHIA

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK

LUNKENHEIMER V

GATE VALVES

Fig. 2125—125 lb. S.P.
Bronze Double Disc Gate
Rising Stem

Fig. 2129—125 lb. S.P.
Bronze Wedge Disc Gate
Non-rising Stem

VALVES **BOILER MOUNTINGS**
LUBRICATING DEVICES

POWER PIPING SERVICE

UNDER ONE RESPONSIBILITY

ENGINEERING

The drawing on the facing page illustrates a modern solution to a possible piping problem. FLEX-ANAL CHARTS★ (the Power Piping Manual and Hanger Bulletin No. 1863) were used to make the necessary calculations in which stress and force relationship, physical dimensions, effect of radius, weld locations and movements caused by expansion were determining factors. Similar calculations for the solution of any piping problem can be determined by any piping engineer through the use of these books, quickly, accurately and in accordance with the latest approved practice.

PREFABRICATION and ERECTION

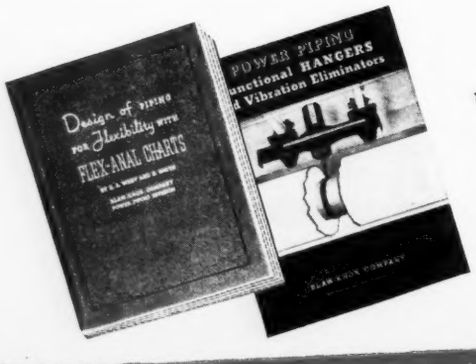
Boiler leads (See A on drawing)
Main header with crossover (See B on drawing)
Turbine leads (See C on drawing)

Prefabricated piping is delivered to the job by Power Piping Division in a series of sub-assemblies that are commercially practicable, heat treated or stress relieved when necessary, shop tested, accurately aligned, thoroughly cleaned and inspected. Good engineering practice considers PREFABRICATION of vital importance to the satisfactory completion of a first class piping installation.

FUNCTIONAL HANGERS
VIBRATION ELIMINATORS

These necessary component parts of a modern piping system permit economical design through the use of multi-rolling action which allows large movement of piping without restriction. Hanger types 6 and 7 (See D on drawing) supporting the turbine leads — adjust themselves to any location and permit piping designers to meet the requirements of turbine manufacturers by minimizing thrusts on turbine flanges, etc., due to hanger load components (See E on drawing).

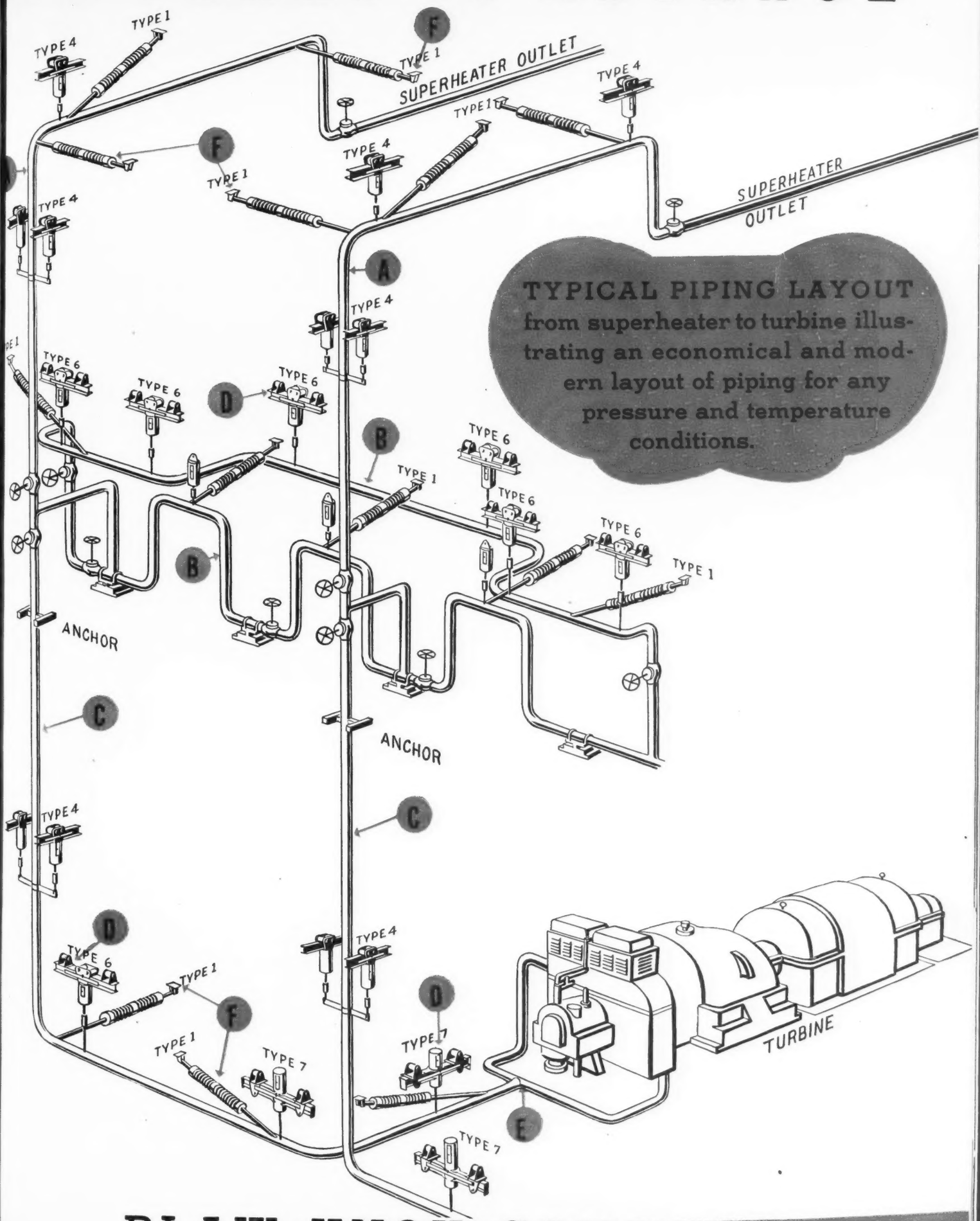
Vibration Eliminators (See F on drawing), absorb shock and vibration without restricting pipe expansion and movement. They prevent repetition of stress and eliminate metal fatigue, thereby complying with the code for pressure piping.



★ These two books constitute a service offered by Power Piping Division for the benefit of the engineering fraternity and will be sent FREE to any engineer requesting them on his business letterhead.

On receipt of sketch or prints showing any piping system we will gladly recommend the proper hanger and vibration eliminator layout without obligation.

IS YEARS IN ADVANCE



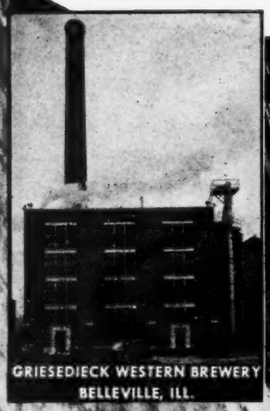
TYPICAL PIPING LAYOUT from superheater to turbine illustrating an economical and modern layout of piping for any pressure and temperature conditions.

BLAW-KNOX COMPANY

POWER PIPING DIVISION

1525 PENNSYLVANIA AVE., PITTSBURGH, PA.

COCHRANE EQUIPMENT HELPS BREWERY CUT STEAM COSTS BY 27.5%



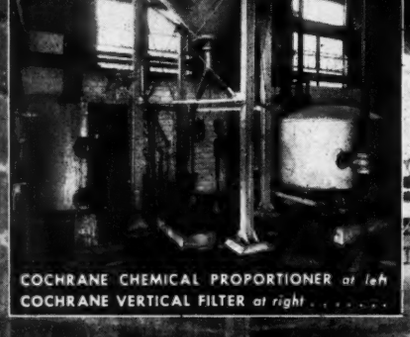
GRIESEDIECK WESTERN BREWERY
BELLEVILLE, ILL.

A COCHRANE Deaerating Hot Process Softener is installed as part of the modernized boiler plant of the Griesedieck Western Brewery, Belleville, Ill.

Also installed are a Cochrane Chemical Proportioner and tank, a Cochrane Vertical Filter, and a Cochrane Mechanical Flow Meter measuring total steam flow.

The Cochrane feedwater conditioning equipment safeguards a new 4-drum bent tube boiler which replaced three old boilers. Records of the new equipment as compared with the old show a saving in fuel costs alone of 27.5%.

COCHRANE CORPORATION
3106 N. 17th St., Philadelphia, Pa.



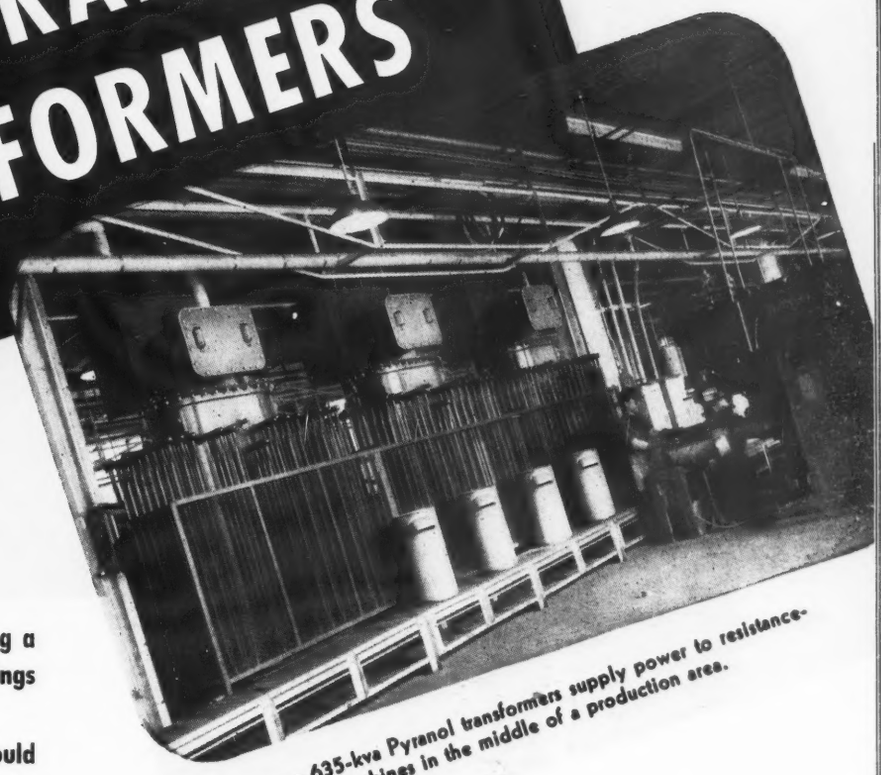
COCHRANE CHEMICAL PROPORTIONER *at left*
COCHRANE VERTICAL FILTER *at right*

Background Photo:
SEDIMENTATION TANK OF COCHRANE DEAERATING SOFTENER EXTENDING THROUGH TWO STORIES OF BOILER HOUSE

Cochrane

WATER SOFTENERS • DEAERATORS • FILTERS • METERS • SPECIALTIES

TO THE HUNDREDS OF NEW USERS OF PYRANOL TRANSFORMERS



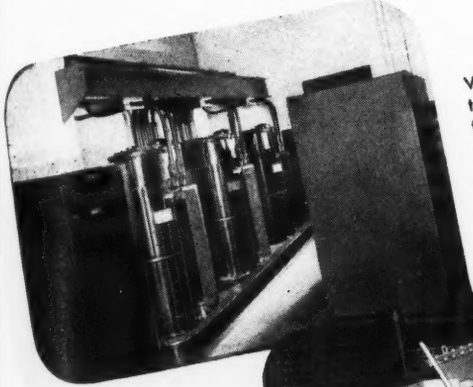
These 635-kva Pyranol transformers supply power to resistance-welding machines in the middle of a production area.

By installing Pyranol transformers (instead of making a conventional transformer installation) you made big savings in materials and over-all installed cost.

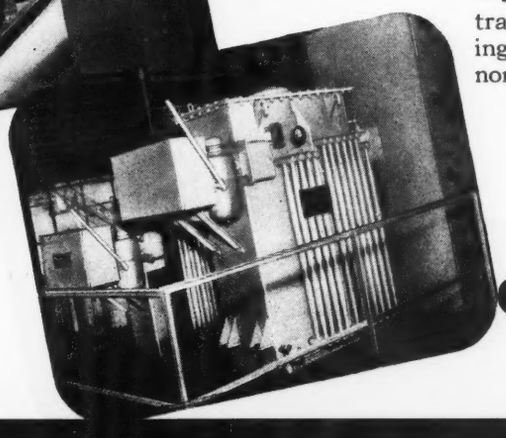
You reduced installation time and cost, because you could install these transformers indoors without a fireproof vault.

You saved copper—many tons of it if your plant is a large one—because you could install these transformers right at load centers, where transformers were meant to be installed.

You reduced line losses and voltage drop in your plant circuits and assured better performance from motors, resistance-heating equipment, lamps, and other electric equipment.



Vaultless installation of these 225-kva Pyranol transformers in a steel-mill motor room meant savings in materials plus economical power distribution.



These G-E load-center unit substations, incorporating Pyranol transformers, are part of a G-E load-center power-distribution system in an expanding war plant.

Safety of Pyranol—an Asset to Your Plant

Since the introduction of Pyranol in 1932, more than 4,000,000 kva of new transformers have been furnished with this type of noninflammable insulating and cooling liquid. No Pyranol transformer, in 10 years of operating experience, has burned or contributed to a fire.

Greater Reliability—a Continuing Benefit

The high dielectric strength of Pyranol means extra stamina to resist damage from voltage surges resulting from switching operations or lightning. This is a safeguard against progressive deterioration of the insulation that might otherwise result in a transformer breakdown and loss of power service.

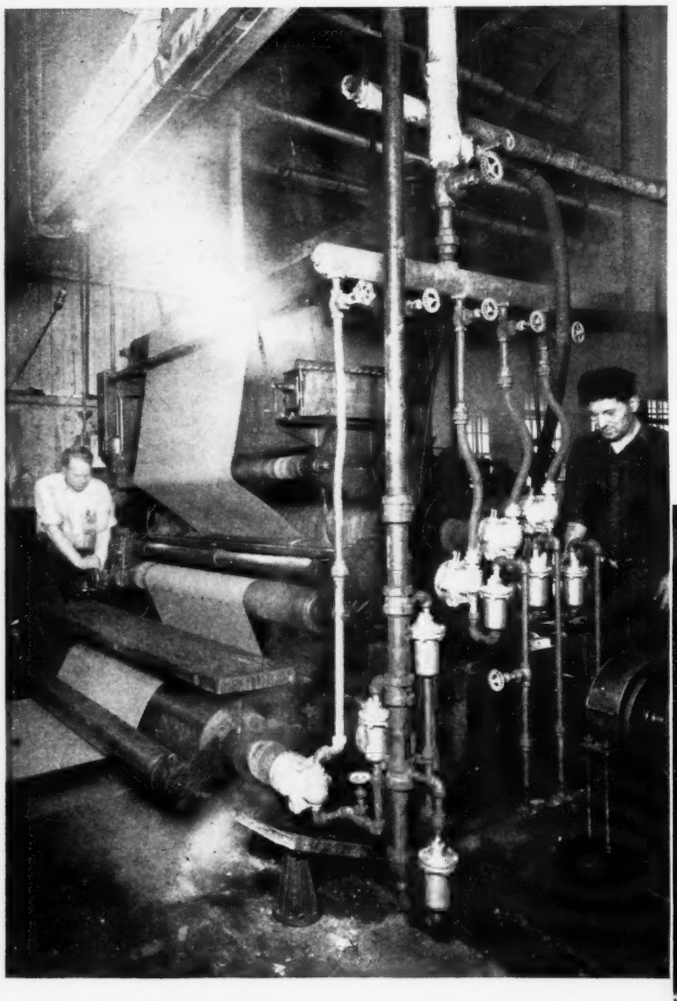
Pyranol transformers have other features that mean greater reliability and little maintenance. The pressure-tight steel tank protects both liquid and solid insulation—keeps out dust, dirt, moisture, and other enemies of transformer life. Pyranol is nonoxidizing and nonsludging. It will retain its insulating properties over years of normal operation. *General Electric, Schenectady, N. Y.*

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

660-52-5300

ARMSTRONG



Higher

Check your Temperatures

50° to 70° Hotter!

● Referring to the installation shown above, Mr. Louis Mancini, Chief Engineer at the Robert Gair Co., Inc., Newton, Upper Falls, Mass., writes: "Our two Langston corrugating machines only had one trap to each machine and the two lower rolls were always fifty to seventy degrees colder than the other four rolls. Now, with individual traps on each roll, I am able to deliver 350°F. on all six rolls at 135 lbs. steam pressure. Unit trapping has also reduced our back pressure 20 lbs."

ARMSTRONG Inverted Bucket

Temperatures HELP BOOST Production

Offered in Side Inlet and Bottom Inlet Styles

WINNING the Production Battle in the shortest possible length of time is the one big objective for Industry today!

Permitting production equipment to operate at any point in efficiency below MAXIMUM is no way to win the battle.

Determining whether process heating temperatures are up to maximum is a matter highly deserving of attention because it so frequently leads to major improvements.

To be assured of highest possible temperatures in steam heated units, use ARMSTRONG UNIT TRAPPING. For complete information, call your local Armstrong representative or write.

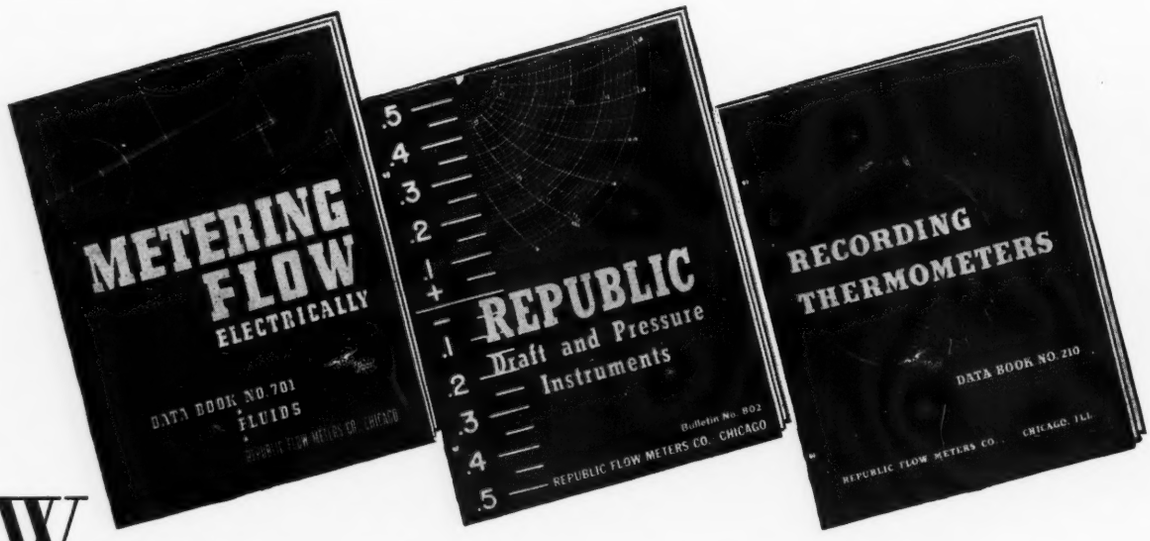
ARMSTRONG MACHINE WORKS
812 MAPLE ST. THREE RIVERS, MICH.

FEATURES Operating Engineers want in Steam Traps:	THE ARMSTRONG STEAM TRAP:
1. Ability to draw off air.	✓YES
2. Ability to handle hot condensate.	✓YES
3. Ability to handle all ordinary sediment and sludge.	✓YES
4. Freedom from wire-drawing in orifice.	✓YES
5. No steam loss for any load condition.	✓YES
6. Ability to hold tight against vacuum.	✓YES
7. Freedom from friction and wear.	✓YES
8. Small size — light weight.	✓YES
9. Simple construction.	✓YES
10. Large capacity.	✓YES

STEAM TRAPS

Saving Fuel, Metals and Manpower for the Battle of Production

THESE
Data Books
WILL HELP YOU
SOLVE YOUR POWER PROBLEMS



WRITE for these data books now! They are filled with important power plant data generally difficult to locate. When your increased power load demands the installation of new units or the "stretching" of existing plant capacity, you will need this information.

REMOTE READING FLOW METERS — Data Book No. 701

For measuring flow of steam generated by each boiler and the total produced; steam consumed by prime movers and process steam consuming units; water supplied to boilers and pumped to processes; rate of generation, distribution and consumption of natural gas, coke oven gas, compressed air and the like; flow of fuel oil, brine, black liquor and so on; the Republic electrical type flow meter with remote reading instruments, as described in this book, is available.

MECHANICAL FLOW METERS — Bulletins No. 110 and No. 311

When it is desired to measure flow of steam, water, gas, air or oil for the same purposes as outlined above but where remote registration is not required, the Republic mechanical meters described in these books are available.

DRAFT AND PRESSURE INSTRUMENTS — Bulletin No. 802

Proper regulation of draft is one of the most important requirements in obtaining highest combustion efficiency. For indicating and recording drafts, pressures and differentials, Republic indicators and recorders, described in detail in this bulletin, are supplied in any desired combination for all ranges encountered in furnace operation.

RECORDING THERMOMETERS — Data Book No. 210

Measurements of temperature of flue gas, temperatures in vats or tanks, pipe lines, refrigeration systems, ovens, kilns or ducts and so on, are vital in maintaining highest capacity and efficiency in power plant and process equipment. Republic recording thermometers for this service are described in this data book.

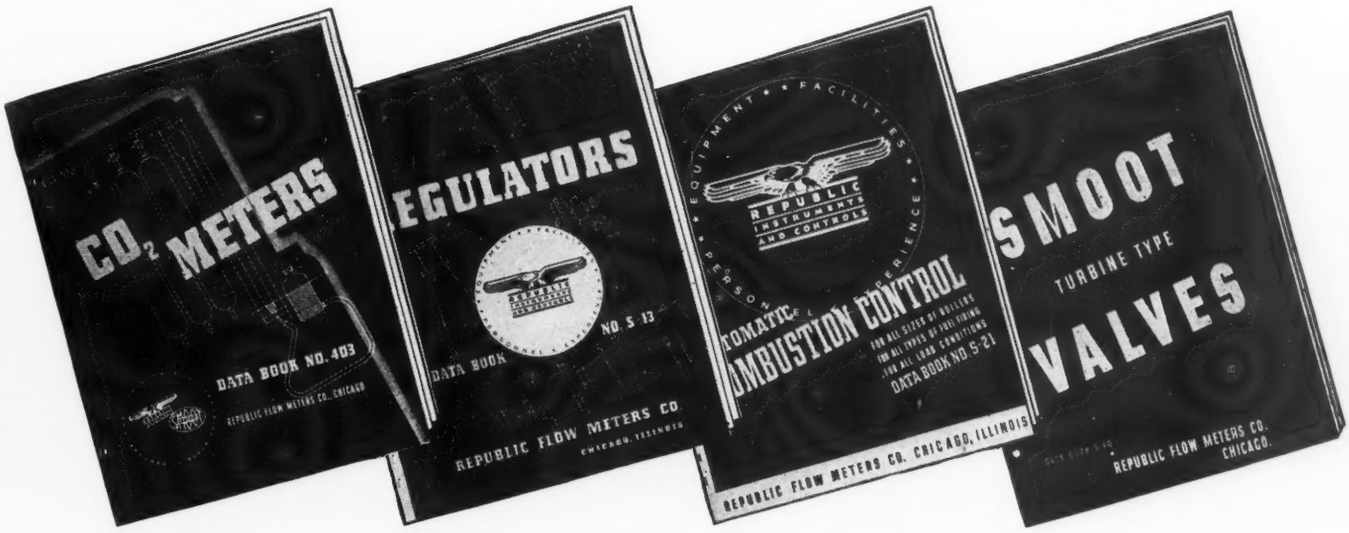
CO_2 METERS — Data Book No. 403

For every fuel and boiler, there is a definite percentage of CO_2 in the flue gas that will assure highest combustion efficiency. The CO_2 meter is the most practical method of determining combustion efficiency. The construction and operation of the Republic CO_2 meter are described in detail in this book.

Republic-Smoot automatic combustion control systems are built for all sizes of boilers, all types of fuel firing and all load conditions, as described in this book, which includes detailed installation reports giving performance data on outstanding power plants.

REGULATING VALVES — Data Book No. S-40

In any plant generating high-pressure, high-temperature steam, there are key valves doing tough jobs in controlling flows or pressures on which vital operations depend — pressure reducing valves co-ordinating high and low pressure steam systems, feedwater valves on 1500 lb. boilers. For such tough jobs, where responsibility, long life and accurate regulation count most and failure must not occur, the Republic-Smoot valves described in this bulletin have been designed.



REGULATORS — Data Book No. S-13

Control of rate of flow of liquids and gases, level of liquids, speed of turbines, engines and motors and proportions between variable pressures and flows must be accurate if maximum plant efficiency is to be attained. These factors are controlled by operation of valves, dampers, rheostats, etc. For sensitive, fast, stable and powerful automatic control of these devices, the Republic-Smoot regulator has been developed. Its construction, operation and applications are described in this book.

AUTOMATIC COMBUSTION CONTROLS — Data Book No. S-21

Boilers must produce maximum steam output at maximum efficiency. That means constant steam pressure, maximum combustion efficiency, constant and correct furnace draft, desired load division among boilers.

DESUPERHEATERS — Data Book No. S-35

In the modern power plant, steam temperatures in interconnected systems — topping turbine bypasses, tie lines, turbine exhaust lines and process steam headers — must be accurately controlled by desuperheaters. For such exacting services, the Republic-Smoot desuperheaters described in this book are employed.

★ ★ ★ ★

Republic Flow Meters Co. offers a complete manufacturing and engineering service in the field of measurement and control. We will be glad to co-operate with you in the solution of any metering or control problem, whether it involves a single instrument or the automatic control of an entire process or plant. Your inquiries will involve no obligation on your part.

Republic Flow Meters Co.

2222 Diversey Parkway • Chicago, Illinois

What! No stand-by Boiler?

YOUR OLD-TIME power man is amazed that power plants today risk running without stand-by equipment.

That's because in the old days, they did not fully realize the importance of correct feedwater service as a *complete* protection against scale, corrosion, carryover, embrittlement, and other feedwater dangers. Today they do . . .

In fact, today most of the plants, now protected by Allis-Chalmers Feedwater Service, are handling their wartime power requirements without reserve equipment of any kind . . . and doing it without risk of unscheduled outages.

That's important to our National Victory Program. And it's important to you in your part in this program.

Here's a *practical* feedwater service founded on Allis-Chalmers' 60 years of experience in building power plant equipment . . . experience that tells us how to get full efficiency out of that equipment. It's an in-your-plant service, employing trained feedwater engineers who solve each specific case on its own facts.

Follow the lead of other big power plant men who are using their full power capacity . . . and protecting it with Allis-Chalmers Feedwater Service. Ask for Bulletin B6133 for the complete story.

A 1480

FIRST STEP — when you submit your feedwater problems to us — is for a trained Allis-Chalmers Feedwater Service Engineer to visit your plant . . . analyze your conditions . . . take samples for preliminary study.

SAMPLES ARE then analyzed in the Allis-Chalmers laboratories . . . specific treatments suggested to prevent scale, corrosion, carryover, embrittlement, and all other feedwater ills, with provisions for changing conditions.

VITAL TO SUCcess of service — the Field Service Engineer in your territory makes frequent calls . . . inspects equipment . . . makes repeated water and steam tests . . . gives you complete feedwater protection at all times.

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

This chart helps operators to do better Oxy-Acetylene Hand-Cutting

CORRECT PROCEDURES VS. COMMON FAULTS IN HAND-CUTTING
(1) Correct Procedure
Compare this cut in 1-in. plate with those below. The edge is square, the drag lines are vertical and not too pronounced.
(2) Preheat Flames Too Small
They are only about ⅛ in. long. Result: cutting speed was too slow, causing bad gouging effect at bottom.
(3) Preheat Flames Too Long
They are about ½ in. long. Result: surface has melted over, cut edge is irregular, and there is too much adhering slag.
(4) Oxygen Pressure Too Low
Result: top edge has melted over because of too slow cutting speed.
(5) Oxygen Pressure Too High
Nozzle size also too small. Result: entire control of the cut has been lost.
(6) Cutting Speed Too Slow
Result: irregularities of drag lines are emphasized.
(7) Cutting Speed Too High
Result: a pronounced rake to the drag lines and irregularities on the cut edge.
(8) Blowpipe Travel Unsteady
Result: the cut edge is wavy and irregular.
(9) Lost Cut Not Properly Restarted
Result: bad gouges where cut was restarted.
(10) Good Kerf
Compare this good kerf (viewed from the top of the plate) with those below.
(11) Too Much Preheat
Nozzle also is too close to plate. Result: bad melting of the top edges.
(12) Too Little Preheat
Flames also are too far from plate. Result: heat spread has opened up kerf at top. Kerf is tapered and too wide.
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THE LINDE AIR PRODUCTS COMPANY
Unit of Union Carbide and Carbon Corporation
New York and UCC Principal Cities
In Canada: Dominion Oxygen Company, Limited, Toronto

Refer to Form 5144 when writing for copies of this chart

Good results in oxy-acetylene hand-cutting depend not only upon the use of efficient equipment, but also upon flame adjustments, oxygen and acetylene pressures, cutting speeds, and the handling of the blowpipe. The chart illustrated is a convenient reference for oxy-acetylene operators. It shows them the results of some of the most common faults of cutting procedures and thus helps operators to keep their work at a high level. *This chart, which is printed on heavy stock 9 by 11½ inches, is available from any Linde office, without charge.* Also available upon request is the helpful booklet, "How to Increase Efficiency in Hand-Cutting Operations."

Operating Instructions

For information on correct gas pressures, nozzle sizes, and cutting speeds, refer to the Instructions furnished with your Oxweld, Prest-O-Weld, or Purox blowpipe. Duplicate copies of these Instructions are available from any Linde office.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

30 E. 42nd St., New York, N. Y. UCC Offices in Other Principal Cities

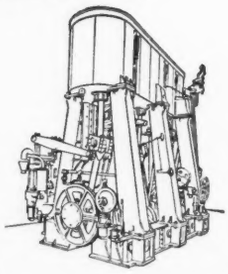
In Canada: Dominion Oxygen Company, Limited, Toronto

LINDE OXYGEN . . . PREST-O-LITE ACETYLENE . . . UNION CARBIDE
OXWELD, PUROX, PREST-O-WELD APPARATUS . . . OXWELD SUPPLIES

The words "Linde," "Prest-O-Lite," "Union," "Oxweld," "Purox," and "Prest-O-Weld" are trade-marks of Units of Union Carbide and Carbon Corporation.

Modernized Steam Engines

for LIBERTY SHIPS



Liberty-type cargo ships were wanted in a hurry but turbine building plants were choked with work for combat ships. So the Maritime Commission specified triple expansion reciprocating engines and these are now being produced in many plants throughout the country by companies such as Worthington Pump & Machinery Corp., General Machinery Corp., Willamette Iron & Steel, and many others.

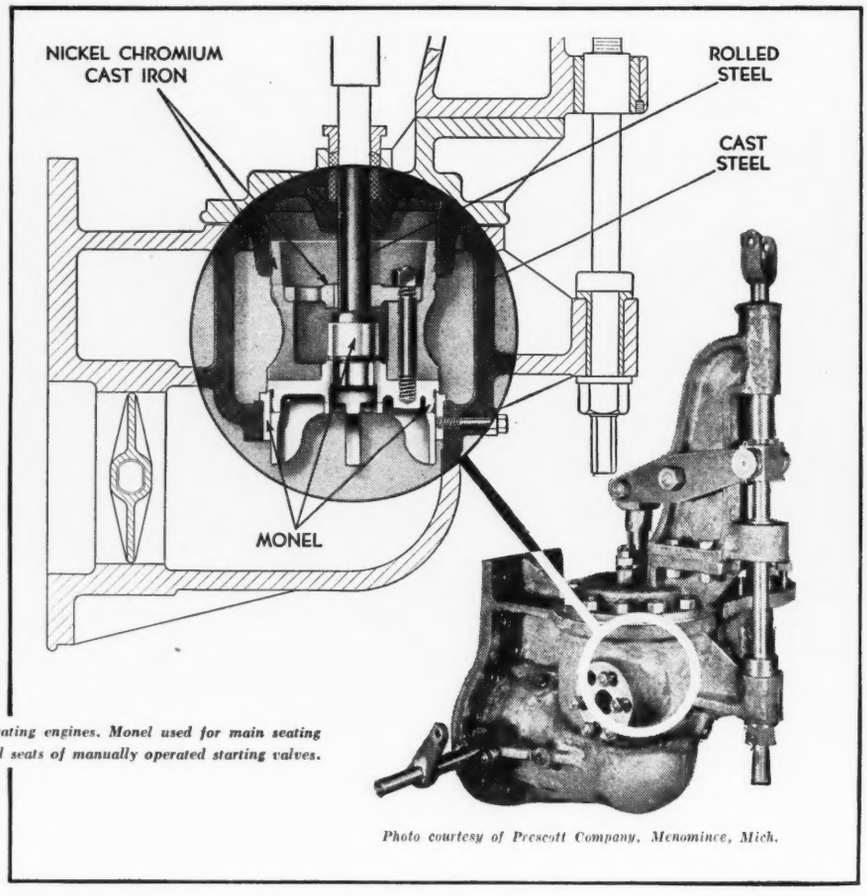
A modern feature added to these old reliable reciprocating engines by Maritime Commission design engineers is Monel for main throttle and pilot valve seating surfaces, and Nickel-chromium alloyed cast iron for main throttle valve piston and piston keep.

In this class of service, 230 pounds W.S.P. steam superheated to 450° F., Monel assures maximum service life with minimum attention. Its strength and hardness at high temperature resist wire drawing across seating surfaces. Monel's heat expansion characteristics at these temperatures are close to those of steel and iron, thus assuring maintenance of initial fitting tolerances. In addition, Monel's immunity to corrosion safeguards highly finished valve surfaces against rusting by condensate during shut down periods.

Monel steam separators, Monel-trimmed soot blowers, Monel vent check valves, and Nickel Alloy refractory bolts are also standard on Liberty ships.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 WALL STREET NEW YORK, N. Y.

★



Main steam throttle valve for Liberty ship reciprocating engines. Monel used for main seating surfaces, pilot valve, disc and seat and for discs and seats of manually operated starting valves.

Photo courtesy of Prescott Company, Menominee, Mich.

★ ★ ★ ★ **INCO NICKEL ALLOYS** ★ ★ ★ ★

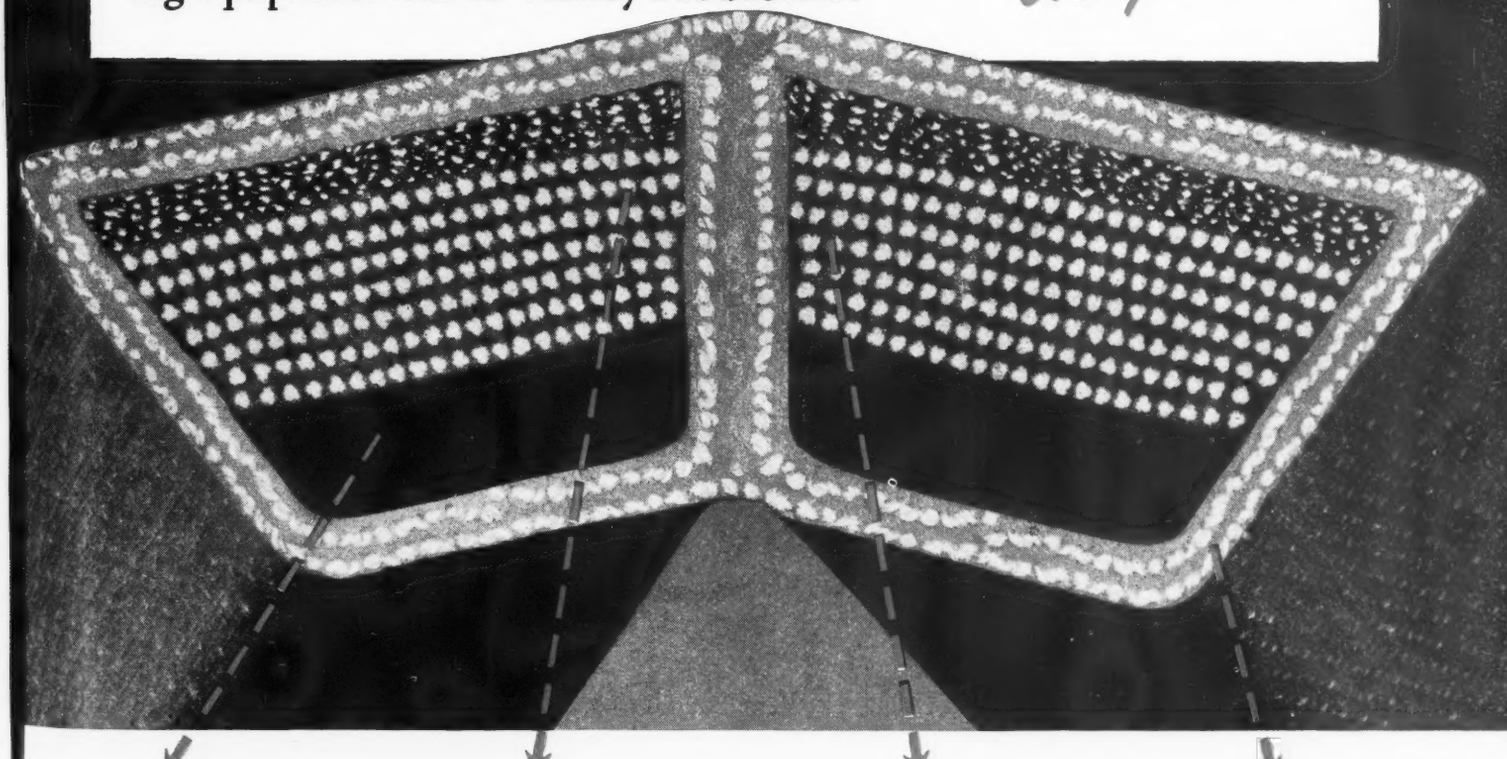
MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • "Z" NICKEL • NICKEL

Sheet . . . Strip . . . Rod . . . Tubing . . . Wire . . . Castings

Open Book on WARTIME CARE OF V-Belts

Texrope Super-7's new Design-Against-Wear points to ways *You* can make V-Belts last longer — whatever brand you now use — saving equipment vital to Victory Production!

V-Day needs every V-Belt



Design-against-heat . . .

Texrope Super-7's revolutionary new shock-absorbing cushion contributes to cool operation.

You can fight friction and heat by preventing misalignment. When present, it subjects V-belts to rubbing on the side . . . builds up heat. So keep grooves in line — shafts parallel.

Design-against-stretch

Texrope Super-7's 50% stronger cords produced by the new Flexon process combat stretching — plus the slip and burning that might result.

You can fight stretch — no matter what make of V-belts you are using — by promptly taking up any extra slack that may develop. Inspect drives regularly!

Design-against-breaks

The 20% more cords built into the new Texrope Super-7 combat strains.

You can fight breaks by requiring that your V-belts never be pried into grooves — nor rolled from one groove to the next. Before installing or removing V-belts, the motor always should be moved forward.

Design-against-dirt . . .

The new Duplex-Sealed cover safeguards Texrope Super-7 against grit, grime and moisture.

You can fight dirt by seeing that your V-belts are wiped off as frequently as conditions require. Never permit dressings to be used on your V-belts. Remember, oil is poison to rubber!

A 1542

ALLIS-CHALMERS

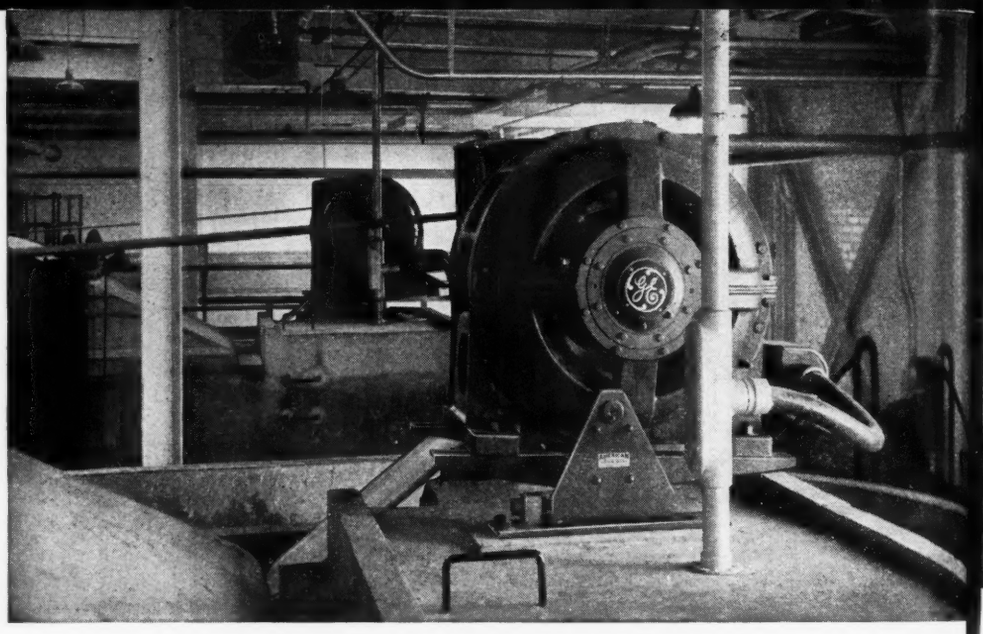
WE WORK FOR VICTORY — WE PLAN FOR PEACE

TEXROPE* SUPER-7 V-BELTS

*Trade mark registered U.S. Patent Office. Texrope Super-7 V-Belts are the result of the cooperative research and design genius of two great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by Allis-Chalmers. Available in all sizes.....½ h.p. to 2,000 h.p.

Conservation Demands:—Save Belts,

AMERICAN



***ECON-O-MATIC DRIVES** are **American Short-Center Drives**, either flat-belt or V-belt, with **American Econ-O-Matic Motor Bases** for automatic tension control . . . and thus automatic economy . . . in materials, maintenance man-hours and electric power.

With 44 American Econ-O-Matic Flat-Belt Drives Ecusta Paper Corporation's Beaters Have Operated Several Years Without a Letdown!

Washer breaker beaters in a paper mill have a tough job. They have to beat pulp into the consistency required by paper machines. Beater drives have to withstand heavy starting loads and occasional "shock" loads as more pulp is added. Four years ago, Ecusta Paper Corporation, Pisgah Forest, North Carolina, decided to install short-center belt drives to operate 44 washer breaker beaters.

American Pulley engineers recommended that Ecusta install **American Econ-O-Matic Flat-Belt Drives** to operate these beaters. Equipment installed included 44 of each of the following:

D-15 **American Econ-O-Matic Motor Bases**
18" x 21" **Hi-Torque Motor Pulleys** (driving pulleys)
96" driven pulleys
20" wide endless flat belts on 110" centers
125 HP motors, operating at 514 RPM

RESULTS: Beaters have operated for several years without a letdown. Belt slippage is at a minimum. Belt tension control is excellent, despite wide variations in load. Belt life is exceptionally long.

Service is severe, but **American Econ-O-Matic Drives** have kept maintenance costs so low that the Ecusta Paper Corporation is completely satisfied.

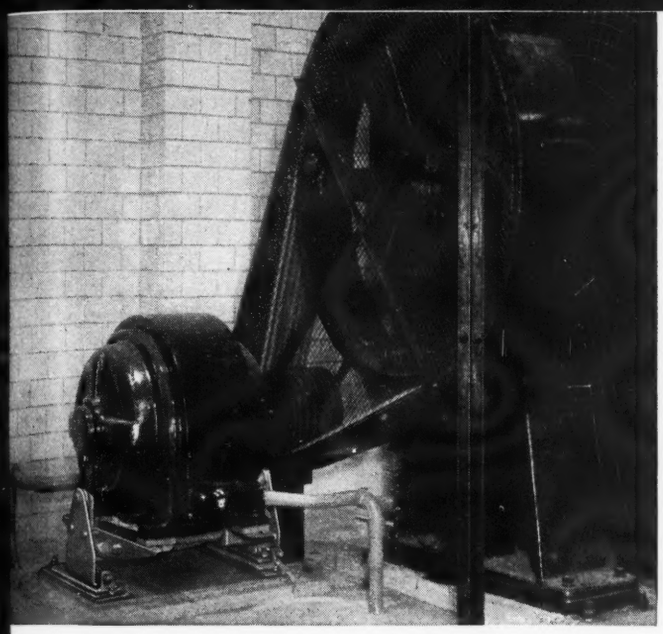
American Econ-O-Matic Drives give this excellent service because they are the most efficient available, according to tests by engineers for leading belting manufacturers. Write today for more information—how to specify short-center power transmission drives, flat-belt or V-belt, for the new machines you're building or buying! There's an **Econ-O-Matic Drive** available to fit your purpose and save production costs!

The American

4242 WISSAHICKON AVENUE

Power, Bearings...and Man-Hours with

Econ-O-Matic* DRIVES



AMERICAN Drive Selection Service

CONSERVATION IS VITAL!

Rubber, duck fabric, leather and other materials from which belts are made are now relatively scarce. Belts must last longer. Because of varying loads on belting, automatic tension control is necessary . . . for longest belt life. **American Econ-O-Matic Drives**, either flat-belt or V-belt, assure these conservation advantages:

1. Belt life increased by an average of 100%.
2. Bearing pressure reduced by an average of 50%.
3. Maintenance costs cut as much as 75%.
4. Power savings often pay the initial cost of **American Econ-O-Matic Drives** within the first year!

8 American Econ-O-Matic Bases Make V-Belts Last Longer in George Washington Bridge Entrance Tunnel!

In the West 178th Street Entrance Tunnel Ventilating Building, at one approach to the George Washington Bridge, there are eight blowers—huge air-conditioning fans that keep air circulating as motorists drive toward the great bridge.

Each blower is driven by a three-speed motor rated at 50 HP at 900 RPM, 15 HP at 600 RPM, and 2.5 HP at 300 RPM. Center distance on the drives is 4'8". They were installed early in 1938.

All eight motors are mounted on **American Econ-O-Matic Motor Bases,** which assure automatic tension control and thus at least 100% longer belt life. Motor, shaft and fan bearings also last longer . . . with no replacements necessary in four years of service!

Power savings and lower maintenance expense, both in man-hours and materials, are other advantages of these eight drives. Performance has made these **Econ-O-Matic Motor Bases** an excellent investment—they've paid for themselves in savings!

★ ★ ★

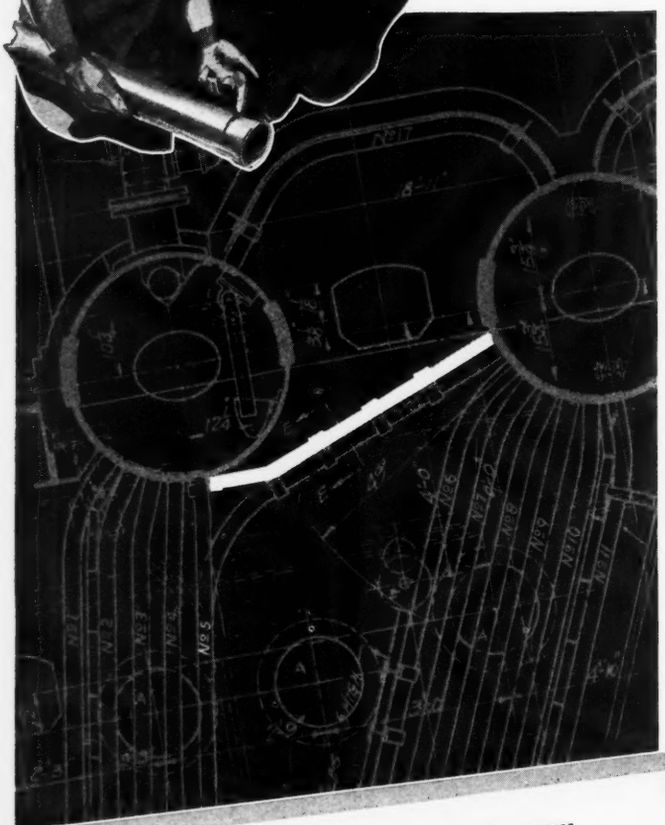
Ask your "American" Distributor to show you the new ECON-O-MATIC DESK PRESENTATION. It shows clearly how the principle of automatic tension control works . . . and how **American Econ-O-Matic Drives** speed production, increase belt life, reduce bearing pressure, cut power bills and save an average of 75% in maintenance expense.

Pulley Company

PHILADELPHIA, PA.

Why did **SIX** tubes crack . . . and no more?

ANOTHER UNUSUAL STORY OF HALL SERVICE



TIME: Early last year.

PLACE: Hall-client boiler plant.

TROUBLE: Four-drum, bent-tube-type boiler being returned to service after ten-year shutdown—six tubes in No. 5 row between back top and bottom drums found severely cracked transversely at upper-end tube seats. Boiler inspector and plant superintendent feared cracking was of embrittlement type. Familiar with embrittlement detectors through discussions issued by Hall Laboratories, superintendent ordered a detector to find out if water had embrittling characteristics.

HALL ANALYSIS: Trouble-shooting Hall service man inspected boiler and cracked tubes—searched particularly for special conditions of possible significance. Only six tubes in No. 5 row were cracked, distributed evenly across the row, *not* confined to any one section. Gas baffle between middle and back drums was supported partly on special tubes—No. 22 row—partly by clamps around six tubes in No. 5 row. Cracked tubes all failed in same relative location—circumferentially within the seat—in each case on tube fronts. *The six tubes that cracked had been those which supported the baffle!*

SOLUTION: When baffle was first installed, supporting clamps were so attached that expansion imposed excessive stress on tubes at their upper seats. Now, with baffle attached to six new tubes in a way that prevents excessive stress, no more trouble has occurred. Nevertheless, use of embrittlement detector will prove whether or not water is embrittling in character—a particularly interesting case because there is plenty of sulphate in the water to maintain the constant ratio of sulphate to alkalinity recommended by the A.S.M.E. code for protection from embrittlement.

What Hall Service can do for you

Hall Service means far more than just water conditioning. Hall Engineers help you keep your plant *in operation*, whether the problem is one of scale, corrosion or embrittlement in your boiler, or any of several other difficulties encountered both inside and outside your power plant.

This kind of service is particularly important in times like the present, when new equipment is difficult, if not impossible, to secure. Call in a Hall Service Engineer for a thorough check-up of your boilers. You will be infinitely better equipped to prevent troubles before they cripple your plant—at a time when you have *got* to make the *most* of what you *have*.

HALL LABORATORIES, INC. · HAGAN BUILDING · PITTSBURGH, PA.

HALL SYSTEM *of Boiler Water Conditioning*

Round the World Every 8 Days

THAT'S THE RIM-TRAVEL of a rotor in many electric motors working on the new 24-hour-a-day, 7-day-a-week Victory schedule!

And keeping 'em rolling at *that* rate is no job for maintenance, peace-time-style!

Figure it out . . .

With no quitting time for motors — no holidays — their working time has shot up from 1800 hours a year to 8700 hours a year. That's a *4-time* increase.

Maintenance, too, must be quadrupled!

And *quality* of motor care must now be finer. So long as free men wait for guns to defend themselves, shutdown costs must be measured in human lives.

Thus the vital importance of "A Guide to Wartime Care of Electric Motors" — published by Allis-Chalmers and free for the use of U. S. industry. Tear out the order form below and send in for *your* free copy today.

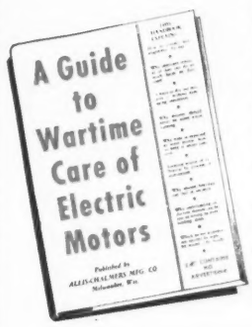
All-out Production depends on All-out Maintenance. Get this free Book →

Here's the answer to the question, how to keep motor maintenance in step with hustling war production? And it's a *clear* answer!

You'll find "A Guide to Wartime Care of Electric Motors" liberally illustrated — *interesting reading*—a great help in training new men in your plant.

This handbook contains no advertising. It applies to *all* makes of standard, general-purpose motors — is *packed* with useful facts.

Every engineer production manager, maintenance man and executive should have "A Guide to Wartime Care of Electric Motors" in his technical library.



ALLIS-CHALMERS MFG. CO.
Advertising Dept.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive *free of charge* "A Guide to Wartime Care of Electric Motors" . . .

_____ (Name)

_____ (Title)

_____ (Company)

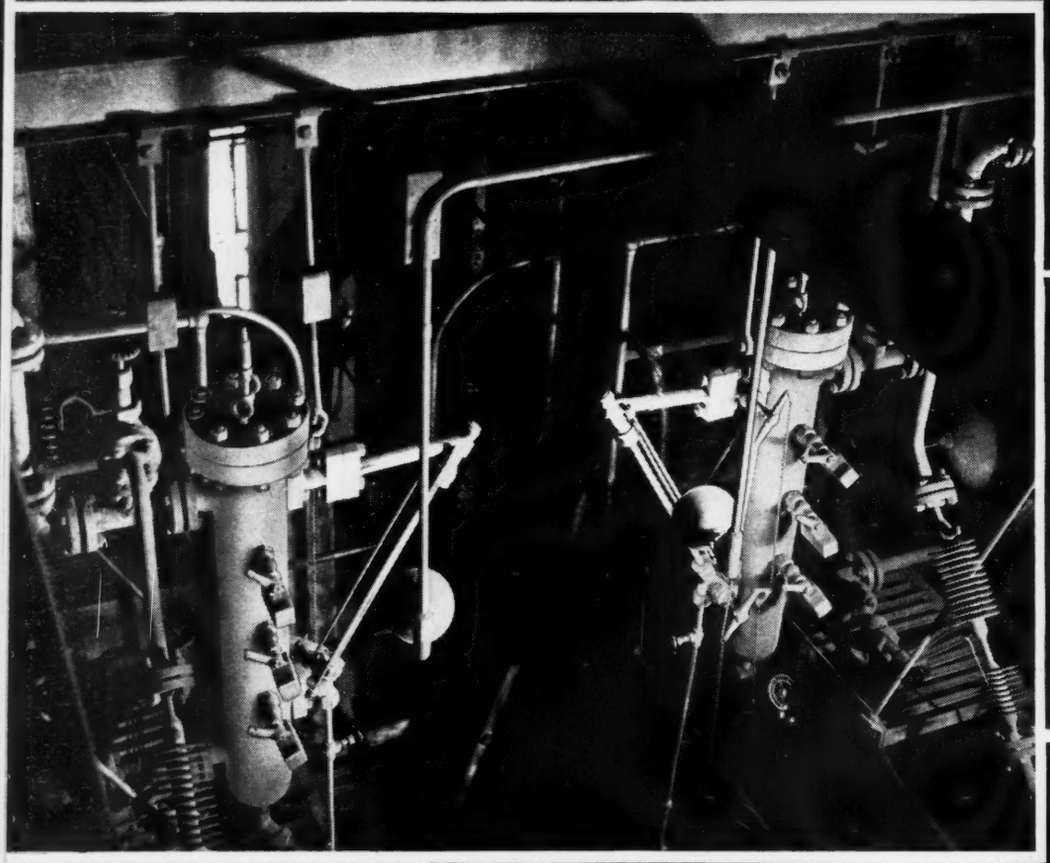
_____ (Street Address)

_____ (City and State) A 1534-9

ALLIS-CHALMERS
MILWAUKEE·WISCONSIN

WE WORK FOR VICTORY WE PLAN FOR PEACE

It's YARWAY



Left: Bird's-eye view of two of the three Yarway HI-LO Alarm Water Columns and Yarway SE-SURE Inclined Water Gages at the Bergstrom Paper Co. plant. These three boilers generate 2,000,000 lbs of steam every 24 hours.

Right: There are 48 Yarway Seatless Blow-Off Valves used in tandem—eight sets to each boiler—at the Bergstrom Paper Co. plant. These valves, operated every 12 hours, day-in and day-out, have totalled approximately eight thousand blow-downs in their fourteen years of faithful service.

YARWAY

All the Way at Bergstrom Paper Co.

YARWAY Seatless Tandem Blow-Off Valves, Yarway HI-LO Alarm Water Columns and Yarway SE-SURE Inclined Water Gages—that's the 100% Yarway score at the Bergstrom Paper Co. power plant at Neenah, Wisconsin. Worthy partners in protection of vital power facilities, especially today, when the utmost in efficiency is demanded of every plant.

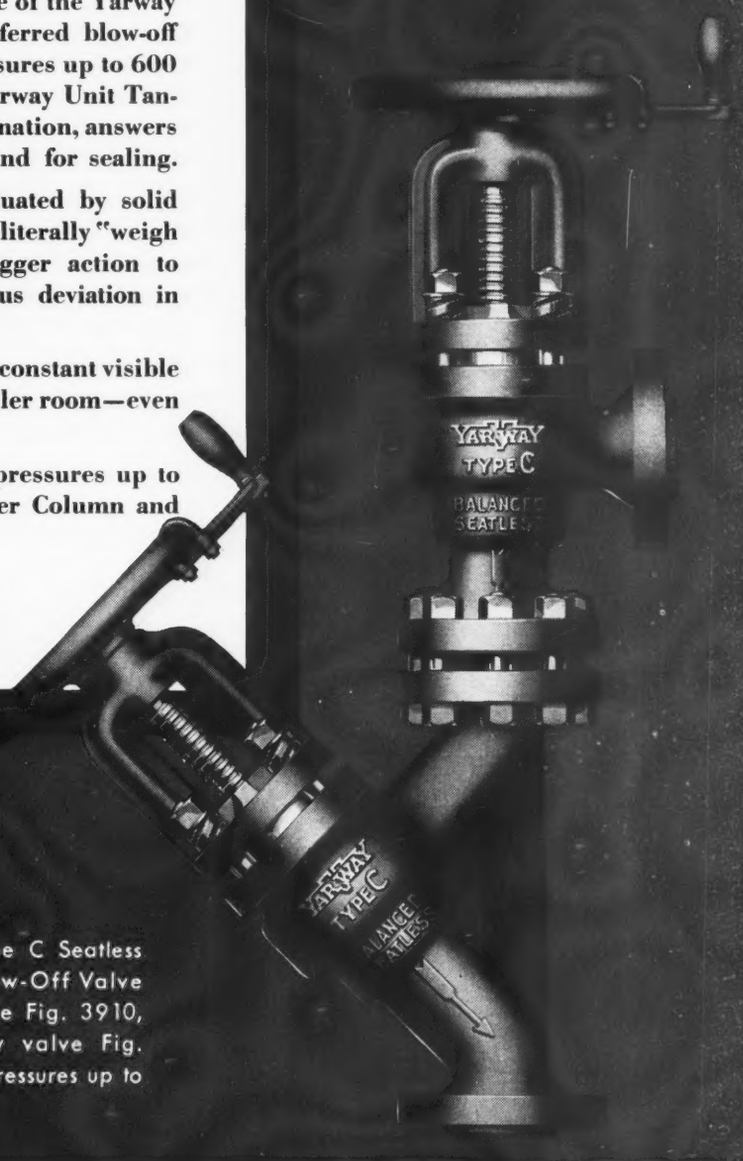
The positive sealing and long, trouble-free service of the Yarway Seatless Valve have made it the most widely preferred blow-off valve for boilers and water-walls operating at pressures up to 600 lbs. For higher pressures (up to 2500 lbs) the Yarway Unit Tandem, utilizing a hard-seat and seatless valve combination, answers all requirements for blowing-down or draining and for sealing.

The Yarway HI-LO Alarm Water Column actuated by solid weights operating on the displacement principle to literally "weigh the water level," gives instant, positive, hair-trigger action to warn by light, whistle, or both, of any dangerous deviation in normal water level.

The Yarway SE-SURE Inclined Water Gage gives constant visible indication of water level from any point in the boiler room—even directly beneath.

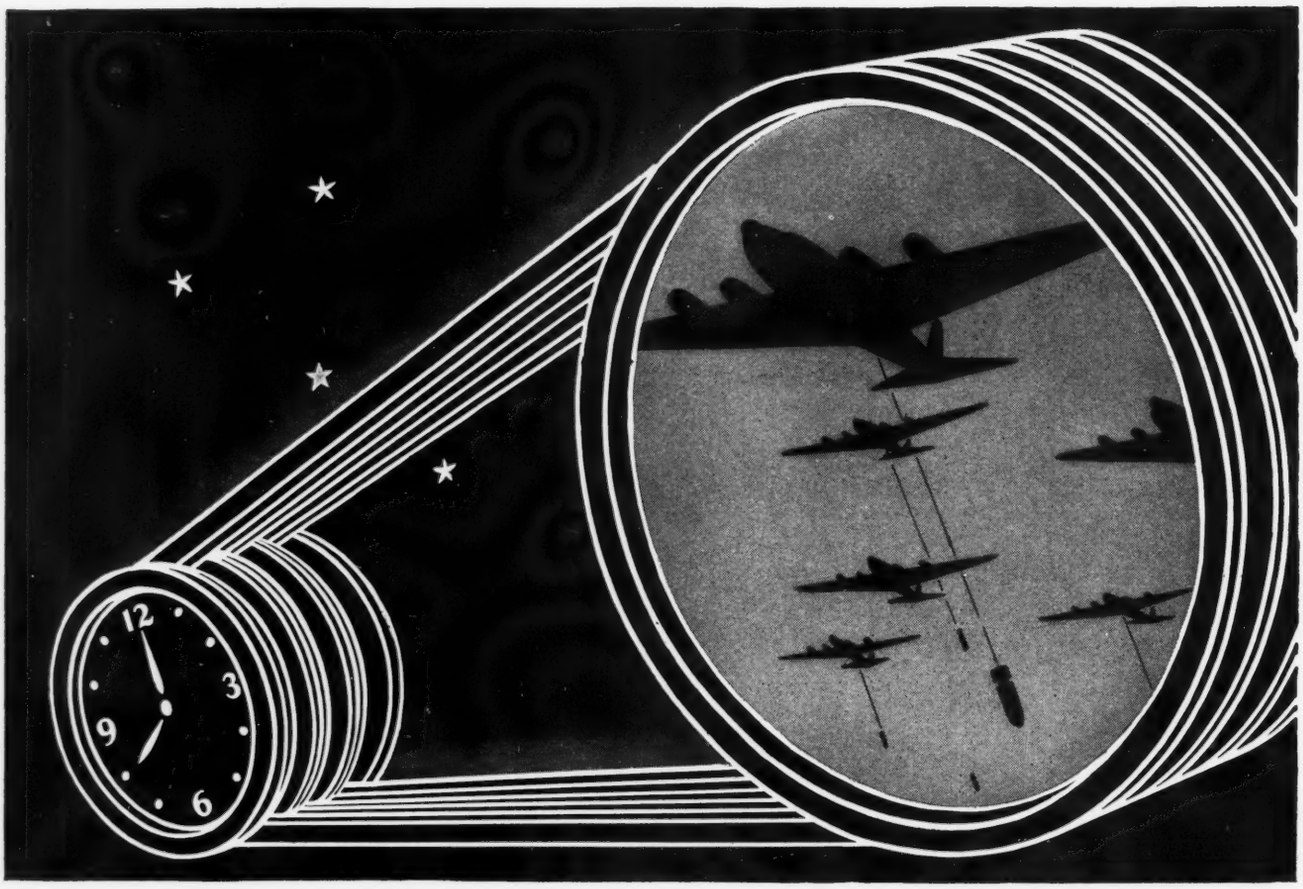
Write for Blow-Off Valve Catalogs B-421 for pressures up to 400 lbs; B-431 for pressures up to 2500 lbs; Water Column and Gage Catalog WG-1808.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia



Yarway Type C Seatless Tandem Blow-Off Valve (angle valve Fig. 3910, straightway valve Fig. 3912) for pressures up to 600 lbs.

STEAM SPECIALTIES



Not "too little and too late" with Multiple V-Belt Drives

TIME AFTER TIME, the events of this war have proved the sorry truth that "too little and too late" inevitably spell disaster. Shortages of planes and tanks and other equipment impose a terrific handicap at frightful odds on the armed forces.

It is fortunate indeed for America at war that standardized Multiple V-Belt Drives are available to transmit power smoothly, quietly, and efficiently to the machines turning out the sinews of war.

And this is true only because, years ago, members of the Multiple V-Belt Drive Association pooled their efforts and information obtained from thousands of experiments and field tests, in developing the *Dominant Drive of Industry—and Victory.*

☆
★ ★

The use of this emblem by an association member in connection with Multiple V-Belt Drives is your assurance of mechanical excellence — the result of co-operative engineering, research and experience.

MULTIPLE V-BELT DRIVE ASS'N

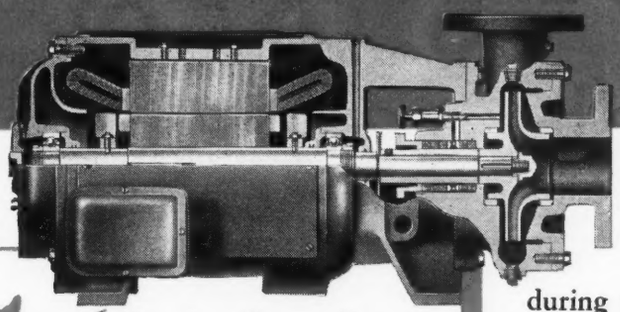
TRADE MARK

The Dominant Drive is the "Victory" Drive

MULTIPLE-V-BELT DRIVE ASSOCIATION
140 SOUTH DEARBORN STREET • CHICAGO

5 REASONS WHY

Here Are 5 Big Reasons Why the New Allis-Chalmers "One Package" Electrifugal Pumps Are Better Able to Serve You Through the War Years . . . and for Years Beyond!



Check These Great One-Package Features

1. *Up to 33% Space Saved* with one frame, one solid driving shaft construction.
2. *Overhang Cut as Much as 40%.* Four solid supports assure precision balance . . . ease strain on vital parts.
3. *New Tri-Fit Design* eliminates 2 section fits for more positive shaft alignment, wearless and vibration-free performance.
4. *Splash-proof* Motor standard equipment—100% designed for pumping.
5. *Easy-to-Get-at* Casing simplifies stuffing box and waterseal gland inspection.

WHEN YOU BUY pumping equipment in wartime, it means — (1) getting top efficiency during the war emergency, and (2) getting longer life and increased economy for the post-war years ahead!

That's why you should know the full story about Allis-Chalmers' new "one-package" Electrifugal Pumps. For here's a line of pumps that are new all the way through — new in design . . . new in construction . . . new in performance.

Listed at left are "5 Reasons Why" these pumps are able to give you this new kind of service. They are important reasons, every one of them. They represent the type of design engineering that makes these pumps the most popular new pumps on the market.

Important, too, is the fact that you can get these new pumps in sizes from ½ hp to 25 hp.

For full details, call the pump engineer in the district office near you. Or write Allis-Chalmers, Milwaukee, Wis.

A 1541

ALLIS-CHALMERS
MILWAUKEE·WISCONSIN

WE WORK FOR VICTORY — WE PLAN FOR PEACE

An Emergency Statement

to Industrial Executives

Manufacturers—large and small—have a special opportunity to aid the war effort—over and beyond the contribution they are already making.

That opportunity is Salvage.

No matter how much scrap is dug out of the attics and basements of homes, the fence corners and gullies of farms, war production factories will still fall far short of the scrap material needed unless the manufacturers of America get 100 per cent behind the program.

Six million additional tons of scrap iron and steel alone, as well as vast quantities of rubber and other materials, are urgently required to bring our war program to full strength.

Whether you are a lace curtain manufacturer or a maker of drop forgings the obligation is the same.

The job is more than simply collecting scrap material around the plant, or turning in the scrap which is created on the premises. It is a job of condemning obsolete machinery, clearing out unusable stocks, obsolete tools, dies, drills, fixtures, etc.

All unusable material, equipment, and stocks should be scrapped at once and put back into war production.

The philosophy of "It may come in handy some day" must give way to the doctrine of "My country needs it now."

Patriotic volunteer committees of executives are already hard at work on this problem in 421 industrial centers.

The Industrial Section of the Conservation Division has a corps of technical advisers who are prepared to work with all types of industries.

A thoroughgoing Salvage program in a factory can not only help meet the present emergency, but can help prepare that factory for its postwar operations through the elimination of once wasteful practices.

1 The first thing to do is to put some one individual in charge of Salvage in all departments of your business and give him not only the responsibility to act, but the authority to act.

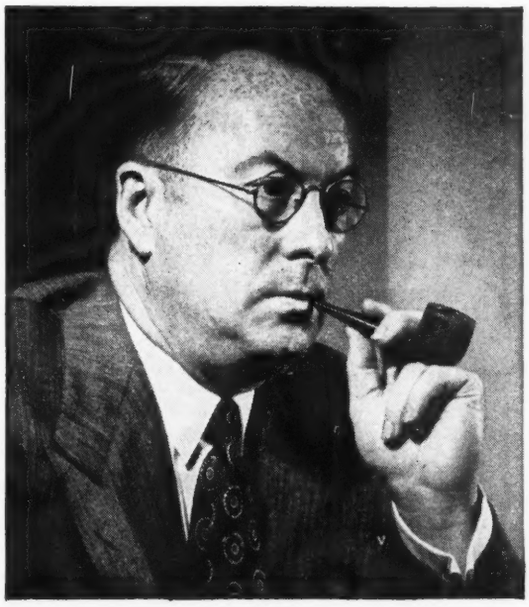
2 The next thing to do is to get in touch with your local Industrial Salvage Committee and map out a detailed program with the materials and ideas that are available. Their program contains 17 simple steps.

If in any doubt, write or wire at once to the Conservation Division, War Production Board, Railroad Retirement Building, Washington, D. C.

This job is being tackled by a democratic nation through the volunteer efforts and initiative of democratically managed industrial concerns, rather than through directives or compulsion as it is done in Axis countries.

Every executive, every superintendent, every foreman and every worker in every plant can help.

The main thing is to get started now.



All unusable material, equipment, and stocks should be scrapped at once and put back into war production. Please read this message and act **now.**

D. M. NELSON, CHAIRMAN, WAR PRODUCTION BOARD

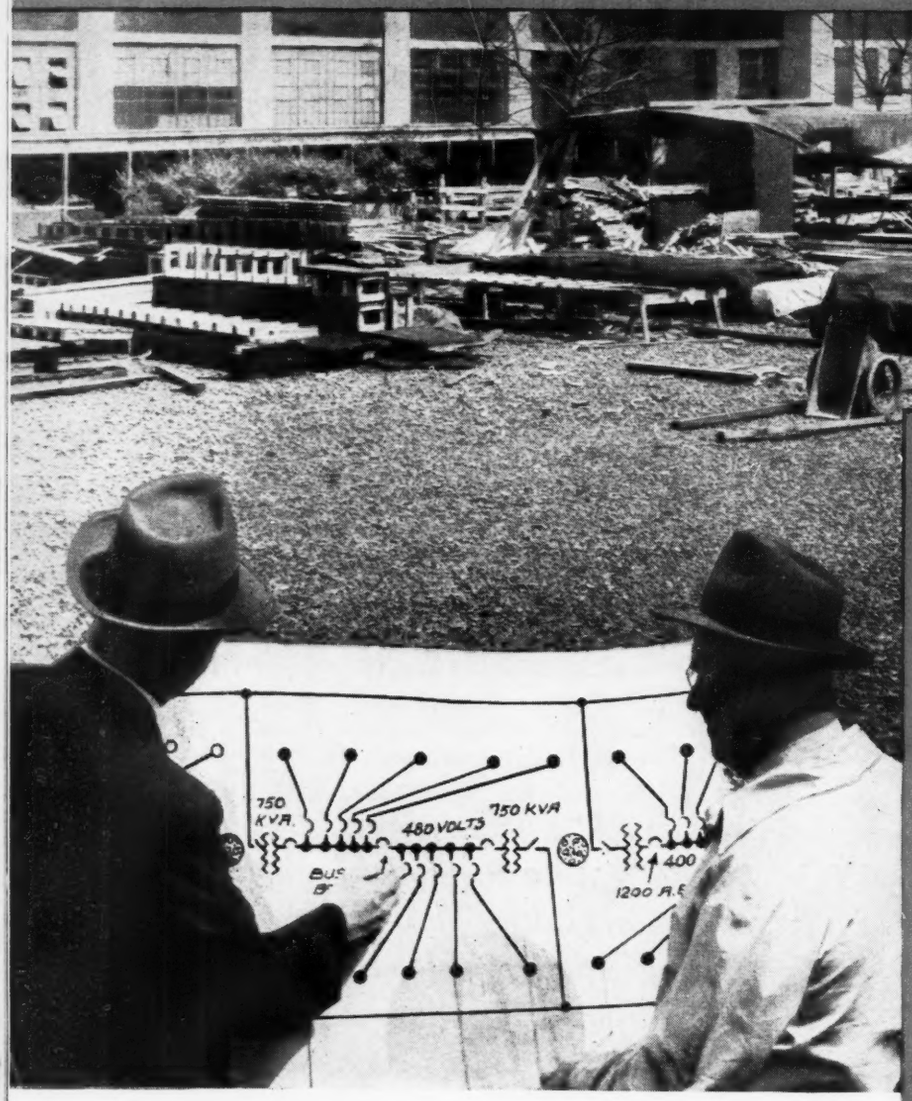
This message approved by Conservation Division

WAR PRODUCTION BOARD

This advertisement paid for by the American Industries Salvage Committee (representing and with funds provided by a group of leading industrial concerns).

SCRAP FROM HOMES AND FARMS—As individuals, search your home from attic to basement. Search your garage. Look at the old familiar things in a new light. Do you need them—or can you get along without them? Your country needs every pound of scrap iron and steel, other metals, rubber, rags and burlap to provide the fighting materials our armed forces must have. Take your scrap to the nearest Salvage Depot—give it to a charity—or sell it to a Junk dealer. . . . If you live on a farm, consult your County War Board or your farm implement dealer. In any case, your scrap will flow back into the blood stream of our war production.

How to PROVIDE PLANT POWER QUICKLY



Take these 3 simple steps and you can order switchgear equipments and unit substations at an early stage of construction—*save weeks of time.*

1. ***Calculate the total kva you need*** Load densities commonly range from 5 to 25 volt-amperes per square foot of floor area. Assembly areas usually fall in the lower range, intensive manufacturing areas in the upper range. Your consulting engineers can help you to predict your load density accurately.

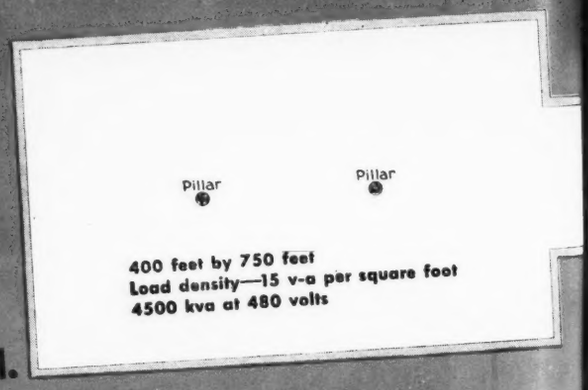
2. ***Divide the load area into separate load zones of 500, 750, or 1000 kva***

3. ***Divide the load of each zone into feeder loads***—and draw a one-line diagram of your proposed load-center system, showing the functions to be performed and the ratings required.

Now, with this one-line diagram, you can immediately order your switchgear and unit substations.

Here's How Equipment Was Ordered for This Industrial War Plant Now under Construction

1.



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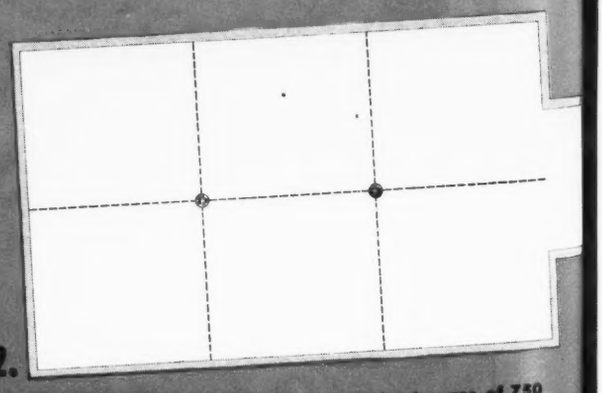
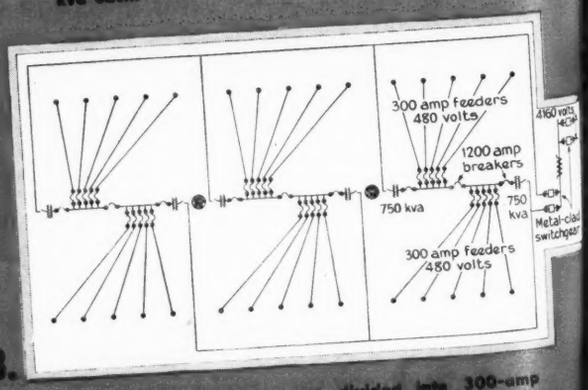
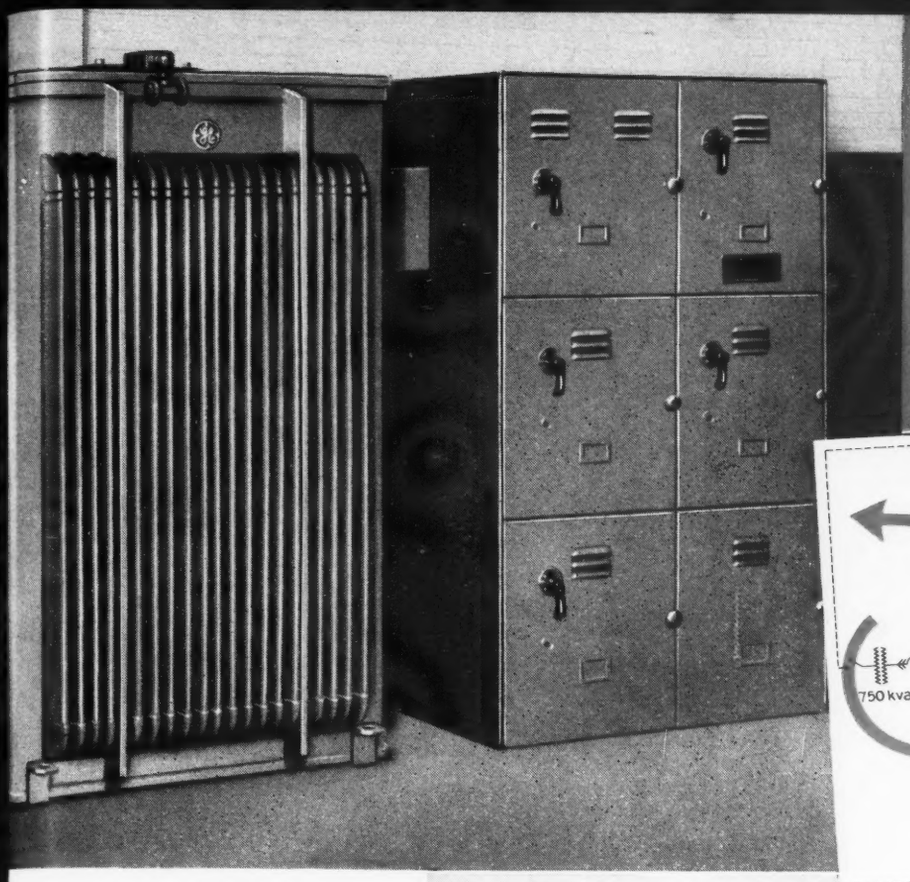


The load area was divided into six load zones of 750 kva each.

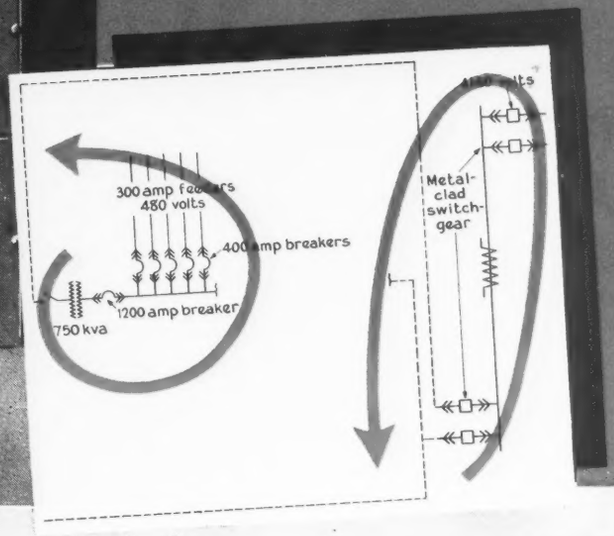
3.



The load of each zone was divided into 300-amp feeders, each zone having 1200-amp breakers for main and bus-tie service. Equipments were ordered promptly by means of a one-line diagram.

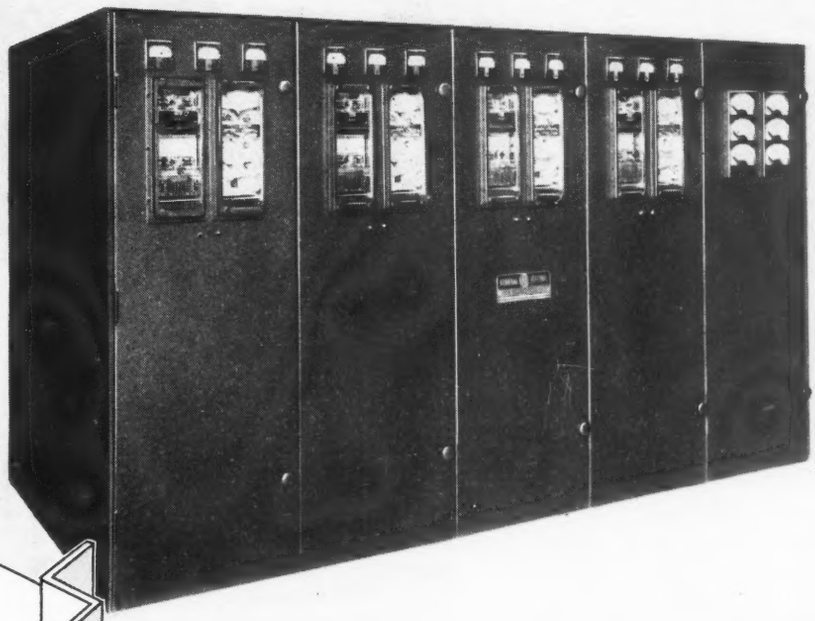


A SIMPLE ONE-LINE DIAGRAM PUTS US TO WORK ON STANDARD EQUIPMENTS

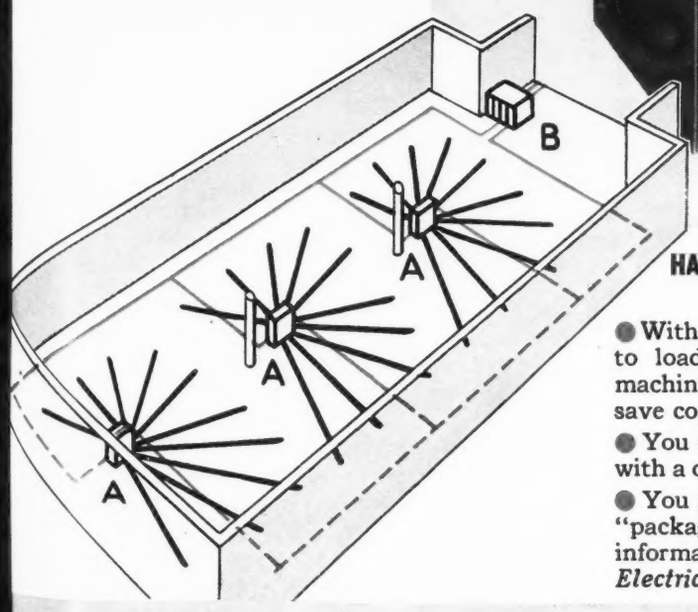


A *Load-center Unit Substations*—including transformer and high- and low-voltage protective and disconnecting devices, all co-ordinated as a single, safe, compact, easy-to-install unit.

B *Metal-clad Switchgear Equipments*—for protecting primary circuits up to 15 kv. A safe, co-ordinated assembly of breakers, instrument transformers, buses, and associated equipment.



General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.



HAVE LOAD-CENTER POWER BEFORE THE FIRST MACHINE IS READY TO ROLL

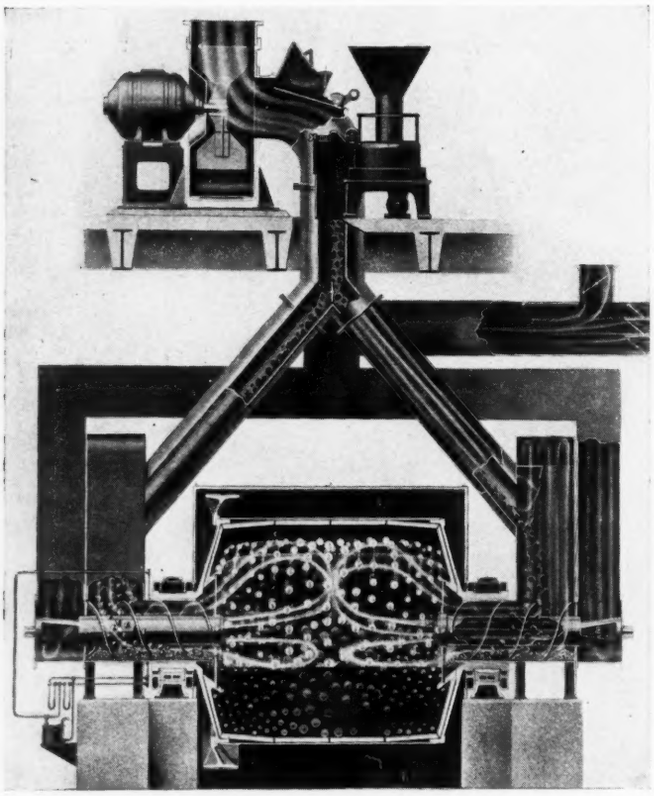
- With load-center distribution, power at high voltage goes right to load-center unit substations, and then directly to your machines through *short* low-voltage secondary feeders. You save copper, steel and dollars.
- You can order *standard* G-E load-center equipments *early*—with a one-line diagram. Get everything you need—weeks sooner.
- You get them ready to set in place and connect—in compact "packages" that can be put in otherwise "dead" area. For full information, contact your nearest G-E Office, or write *General Electric, Schenectady, N. Y.*

GENERAL ELECTRIC

854-17-7300

FOSTER WHEELER PULVERIZER

MAKES HARD GRINDING EASY



Double Classifier Ball Mill

Relative effectiveness of HARDINGE TYPE BALL MILL to other mills increases directly with HARDNESS OF FUEL

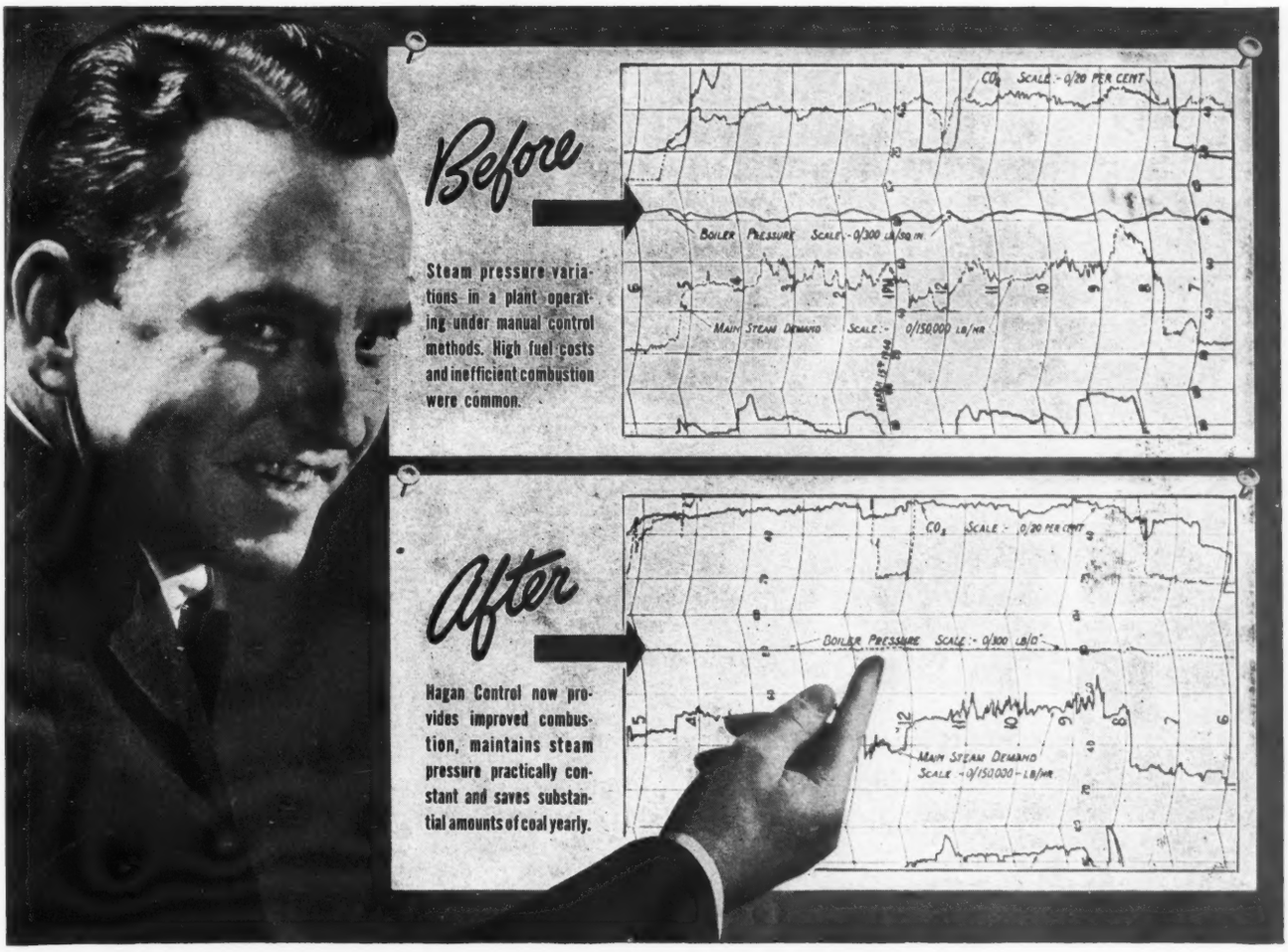
This mill provides high availability without installation of multiple pulverizers per boiler. Typical performance records covering 25 pulverizers having 157 mill-years of service show an average availability of 99.3%. It naturally follows that where availability is high, maintenance costs are low and such is the case with Foster Wheeler pulverized fuel systems. The maintenance cost per ton for these 25 mills was .0132 cents per ton for 7,363,000 tons of coal.

These advantages of the Hardinge type mill reflect in the frequency with which other makes of boilers are supplied with Foster Wheeler mills (134) and the infrequency with which Foster Wheeler steam generators (9) are equipped with other pulverizers.

Foster Wheeler Corporation, 165 Broadway, New York, N. Y.

FOSTER WHEELER

Steam pressure down? Blood pressure up?


Before
Steam pressure variations in a plant operating under manual control methods. High fuel costs and inefficient combustion were common.
After
Hagan Control now provides improved combustion, maintains steam pressure practically constant and saves substantial amounts of coal yearly.

Now more than ever before you need Hagan Combustion Control

LOTS of *blood* pressures, in addition to *steam* pressures, are going for a buggy ride in the hard days ahead *unless* steps are taken *now* to keep present equipment in use at *maximum* efficiency *without* interruption.

One way to get highest efficiency from existing boiler equipment is to install *fully automatic* Hagan Combustion Control. It steps up plant efficiencies to new high levels and keeps steam pressures steady under heaviest load demands. In most cases, too, the improved combustion you get with Hagan Control effects a neat saving in fuel costs.

Here are three more good reasons for installing Hagan Control immediately:

1. Facing skilled-labor shortages because of the war, Hagan Control will maintain your plant efficiency while you break in new men.

2. In case of air raids, which right now are not impossible, Hagan Control will carry on alone until the "all clear" signals your men back to work.

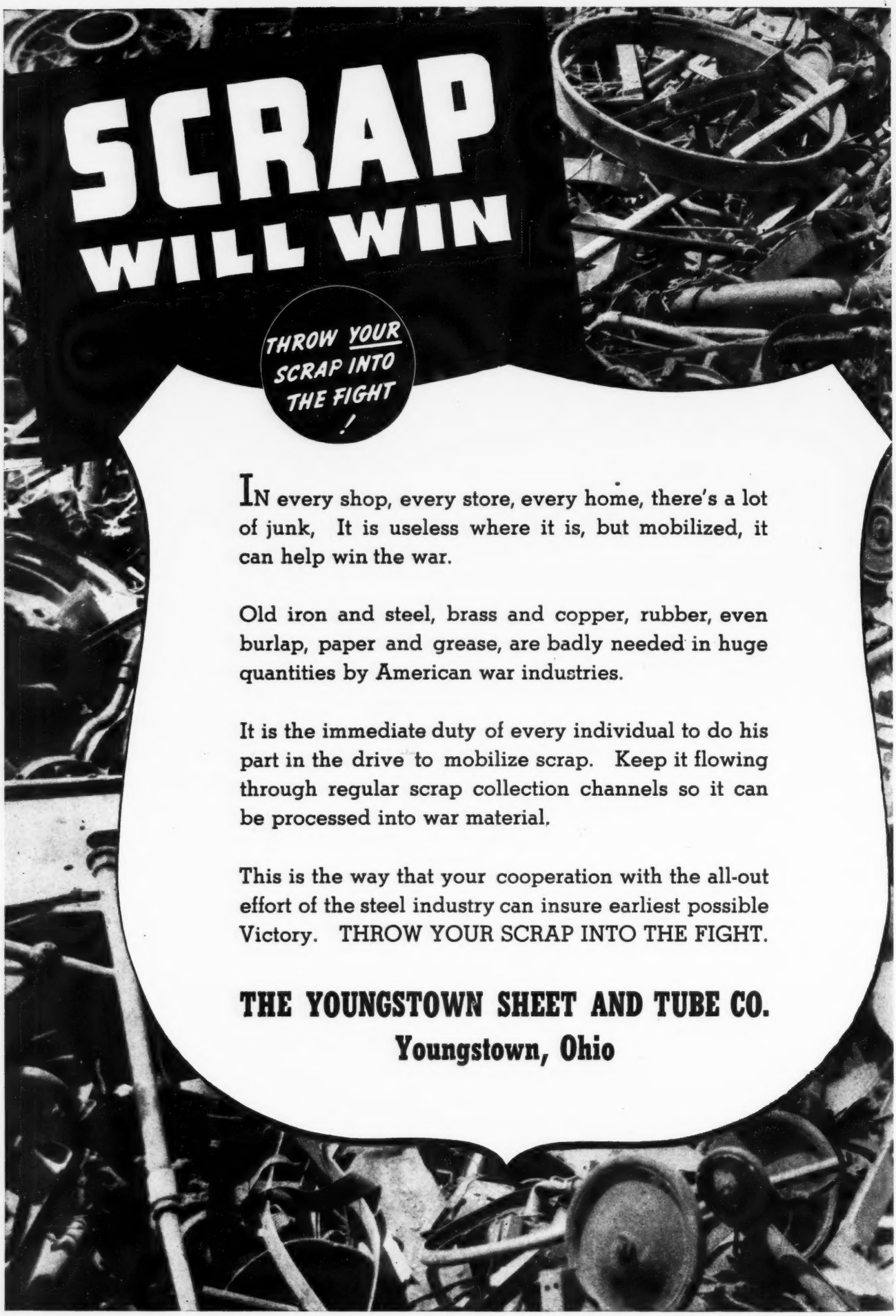
3. If power demands drop suddenly during a black-out, Hagan Control will make the necessary adjustments *automatically* to hold the steam pressure constant.

The time to do it is *now, before* steam pressure losses and plant shutdowns give your blood pressure a high-altitude test. Our engineering staff is at your service. Call or write for complete engineering information without delay.

HAGAN CORPORATION • 300 ROSS STREET • PITTSBURGH, PA.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader



IN every shop, every store, every home, there's a lot of junk, It is useless where it is, but mobilized, it can help win the war.

Old iron and steel, brass and copper, rubber, even burlap, paper and grease, are badly needed in huge quantities by American war industries.

It is the immediate duty of every individual to do his part in the drive to mobilize scrap. Keep it flowing through regular scrap collection channels so it can be processed into war material.

This is the way that your cooperation with the all-out effort of the steel industry can insure earliest possible Victory. THROW YOUR SCRAP INTO THE FIGHT.

THE YOUNGSTOWN SHEET AND TUBE CO.

Youngstown, Ohio

NOW a 2300-volt short is a drop in the bucket

COMPLETE PROTECTION and LONG START-STOP SERVICE

----You get them both in this new 2300-volt starter

THINK of a starter that's built for repeated start-stop service and yet has enough back-up protection to stop a 2300-volt short in a split cycle! You get that kind of service with this starter. It will operate more than a million times with only routine maintenance, and at the same time, provide you with complete protection for your motors, control, and operating personnel. It isn't a mystery control. We combined our long-lived, oil-immersed contactor and EJ-2 current-limiting fuses in one compact, metal-enclosed control unit, and here are the results.

DEPENDABLE OPERATION

The oil-immersed contactor is built to last. Corrosive elements can't get at the operating mechanism. Extra-heavy, self-cleaning copper tips prevent pitting and assure positive contact. Wide metal bearings provide for smooth, continuous contactor operation. Extra-flexible, copper-braided shunts are designed to withstand the severest start-stop operation without breaking or pulling away from their contact. All these features combine to give you a contactor that is going to stay on the job under the toughest of conditions.

FULL PROTECTION

At 2300 volts you want fast, positive short-circuit protection. That's where the EJ-2 current-limiting fuses come on the job. They're split-cycle fuses. When a short occurs, they cut off the current in less than a quarter cycle and clear it in less than a half cycle—long before the short has had time to harm the contactor or motor.

Isothermic overload relays calibrated accurately against actual motor characteristics protect the motor against overheating from sustained overloads, locked rotor, or single-phasing.

Fuses and overload relays working together assure you of full protection at all times.

You'll want to know all about this brand new motor control. How the bus bars are enclosed for the operators' protection. How a group of these starters can be fitted together to give you a neat, compact control panel. Ask your G-E representative for our new bulletin—GEA-3660. It gives full details. General Electric, Schenectady, N. Y.

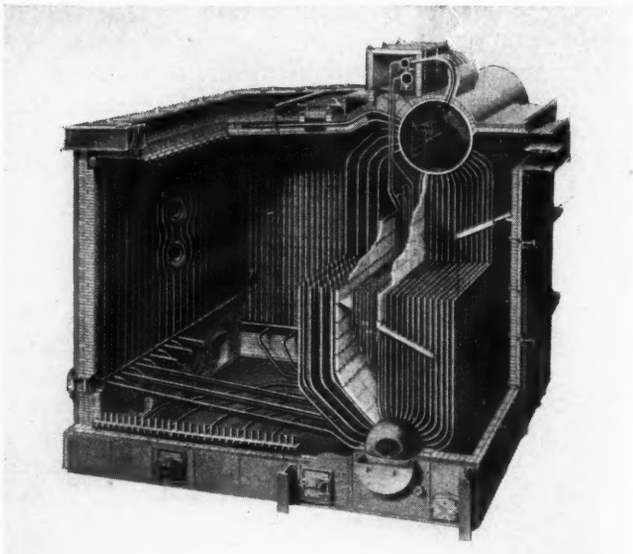
GENERAL ELECTRIC

why Jimmie Fowler of C-E's drafting dept. re-named the VU steam generator

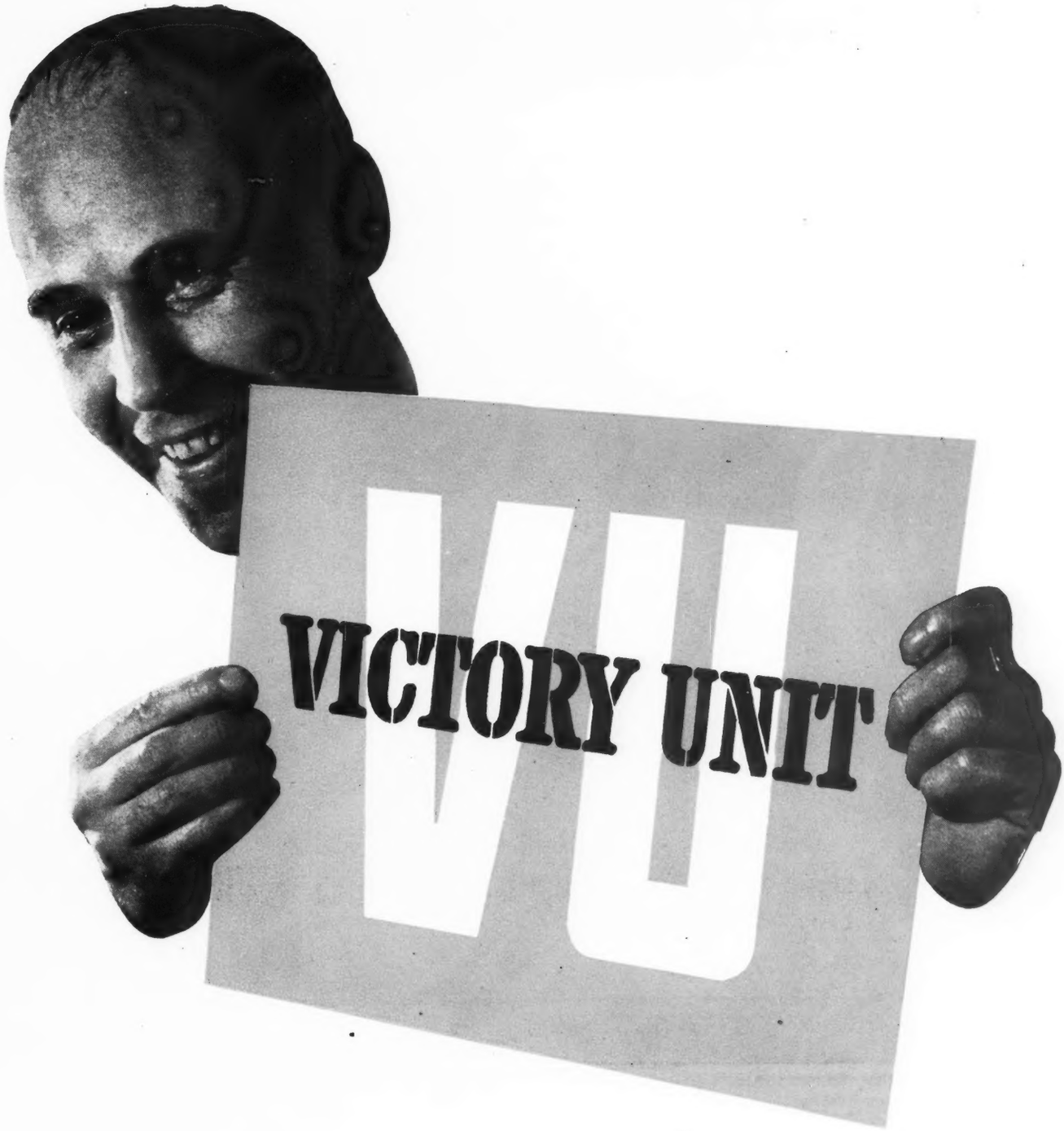
"Jimmie," a squad leader in the VU division of C-E's Drafting Department, is in a good spot to know how much this modern steam generating unit is doing for the war industries.

He knows that over 100 of these units have been purchased for T.N.T. and smokeless powder plants, for shipyards, navy yards, naval bases, air fields and for The Defense Plant Corporation. He knows that these units can make a vast quantity of steam—over 10,000,000 lb per hr—to produce power for Victory.

Inspired by this picture, it was a natural step in Jimmie's mind to change the familiar designation "VU" to a name that really tells the story, "Victory Unit." And to put his idea to work, he made the sign reproduced opposite and hung it on the wall as a constant reminder to the men in his squad that their jobs are important to Uncle Sam.



Combustion Engineering's Type VU Steam Generator



COMBUSTION ENGINEERING

200 MADISON AVENUE, NEW YORK, N. Y. A-674

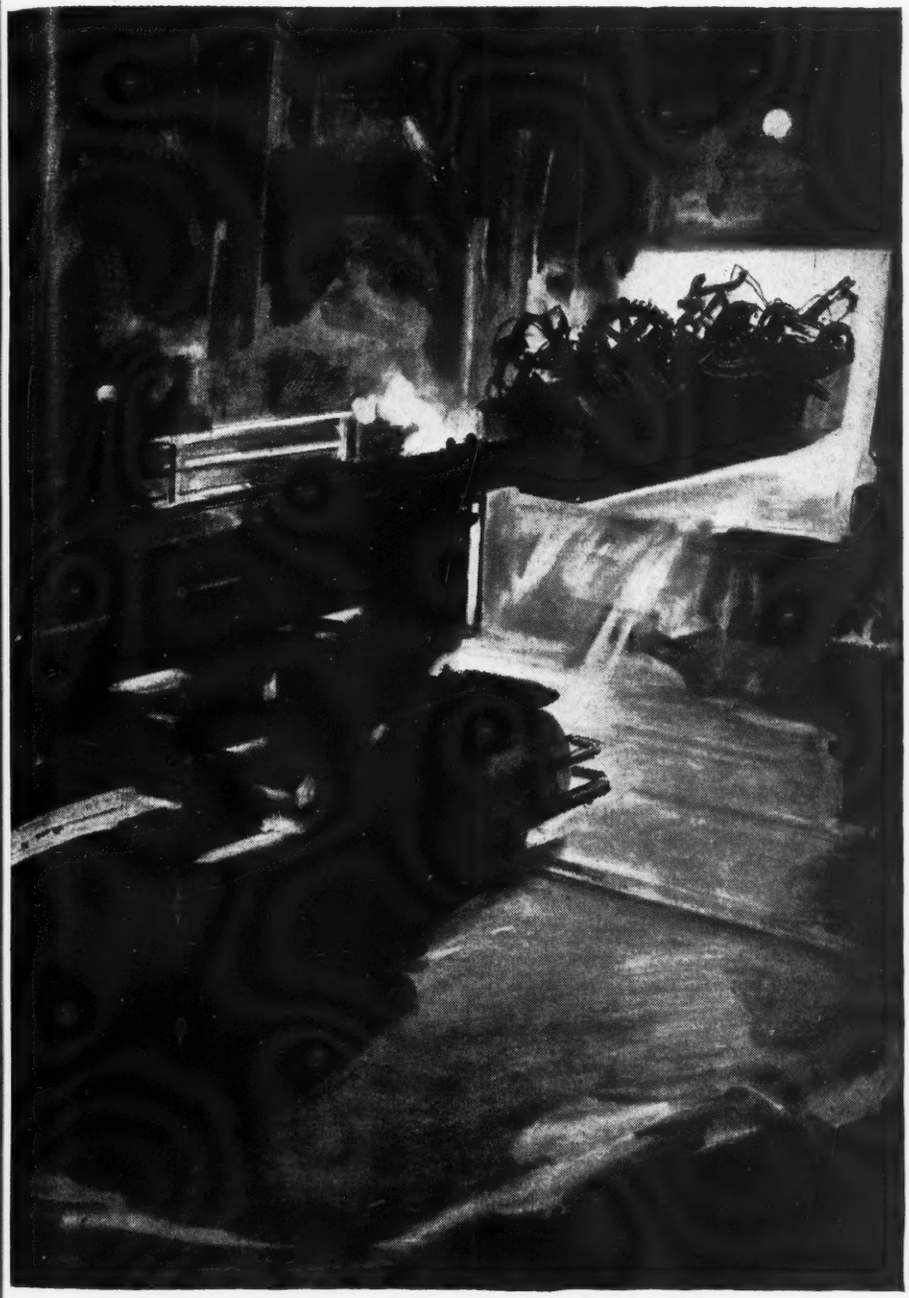
COPYRIGHT 1942—JONES & LAUGHLIN STEEL CORPORATION

STEEL MEN USE SCRAP FOR MAXIMUM

Like coast artillerymen in action with huge railway guns, skilled steelworkers maneuver their hundred-ton charging machines on tracks up and down the batteries of open-hearth furnaces, charging load after load of scrap metal into the seething cauldrons to make strong, fighting steels. Millions of tons of steel scrap are required to keep these war furnaces going twenty-four hours a day, seven days a week.

In adjoining mill yards trained scrap-men load the charging boxes—rush them up to the charging line. Steel scrap, and plenty of it, is vital to making quality battle-steels at a record breaking pace. In the open-hearth operation scrap quickens the process—makes possible efficient use of the natural resources, iron ore, coking-coal and limestone.

Helping men of steel to obtain scrap now for their



FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

WAR-STEEL PRODUCTION

war furnaces enlists every industry and business — every farmer and householder. It partners everyone with the steel workers who are fighting this war with their skill and will-to-do.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

PARTNER TO INDUSTRY IN WAR PRODUCTION

J&L STEEL

SCRAP

Like "mother" in vinegar, scrap steel in open-hearth furnaces activates and stimulates the process, gets refining action of whole batch going in right direction, particularly charge of new molten iron.

½ a battleship, or tank, or sub or big gun is iron or steel scrap that used to be in a discarded tractor, toy, rake, plough, kettle, tool, machine, auto, bathtub, refrigerator. The steel industry in general operates on the basis of 50% scrap, 50% pig iron. Scrap is sorely needed in the war production program. There are millions of tons of it rusting in factories and shops, on farms, in stores, around dwellings. A nationwide campaign is on now to collect and sell to scrap dealers this waste material so essential to winning the war.

The scrap dealer, who pays for waste material turned in to him by individuals, industries or civic and charitable groups, sells it in turn to industry at established, government-controlled prices. However, to make waste material usable for the mills the scrap dealer must properly sort, grade, prepare and bundle it, and also accumulate it in quantities sufficiently large to be shipped efficiently.

Hit Hitler with junk! Every piece of waste iron, steel, copper, brass, lead, rubber, around industrial premises, gathered up and placed where local salvage committees, or Boy Scouts, Girl Scouts, or charity organizations can collect and sell it, will be a blow to the axis.

Industrial executives, with authority to salvage obsolete machinery, tools, dies and all waste that has been created in their operations, are being asked to appoint salvage men, or committees, in their plants to go over the premises with a fine tooth comb and gather the last pound of salvageable junk—particularly iron and steel scrap—which is quickly usable and salable and readily turned into steel greatly needed for war.

Housewives help make bombs by turning in to local salvage committees their discarded appliances of iron or steel. A few hundred worn-out skillets or kettles will make one big aerial bomb.

Gifts of scrap may be made to local charities, service organizations or Defense Councils. If you wish to help government directly, sell your scrap, buy war stamps and bonds.

Obsolete factory equipment, cut up right now and sold as scrap through the regular channels will be a big contribution to our fighting forces. Equipment idle in a factory might also be considered for its immediate salable value as scrap material. The amazing industrial progress going on in America today, rapidly makes obsolete yesterday's machinery and appliances.

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VOLUME 86, No. 8

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POWER

N O WYNKOOP, *Publisher* PHILIP W SWAIN, *Editor*
Associate Editors: F A ANNETT S A TUCKER L N ROWLEY
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Publication office: 99-129 North Broadway, Albany, N. Y.
Editorial & Executive Offices: 330 West 42nd St., New York, N. Y.

CHICAGO, 520 North Michigan Ave.
SAN FRANCISCO, 68 Post St.
WASHINGTON, National Press Bldg.
PHILADELPHIA, 16 South Broad St.
CLEVELAND, 1510 Hanna Bldg.
DETROIT, 2-144 General Motors Bldg.
ST. LOUIS, 455 Paul Brown Bldg.
BOSTON, 1427 Statler Bldg.
ATLANTA, 1011 Rhodes Haverty Bldg.
LOS ANGELES, 601 W. 5th St.
LONDON, Aldwych House, Aldwych, London, W.C.2

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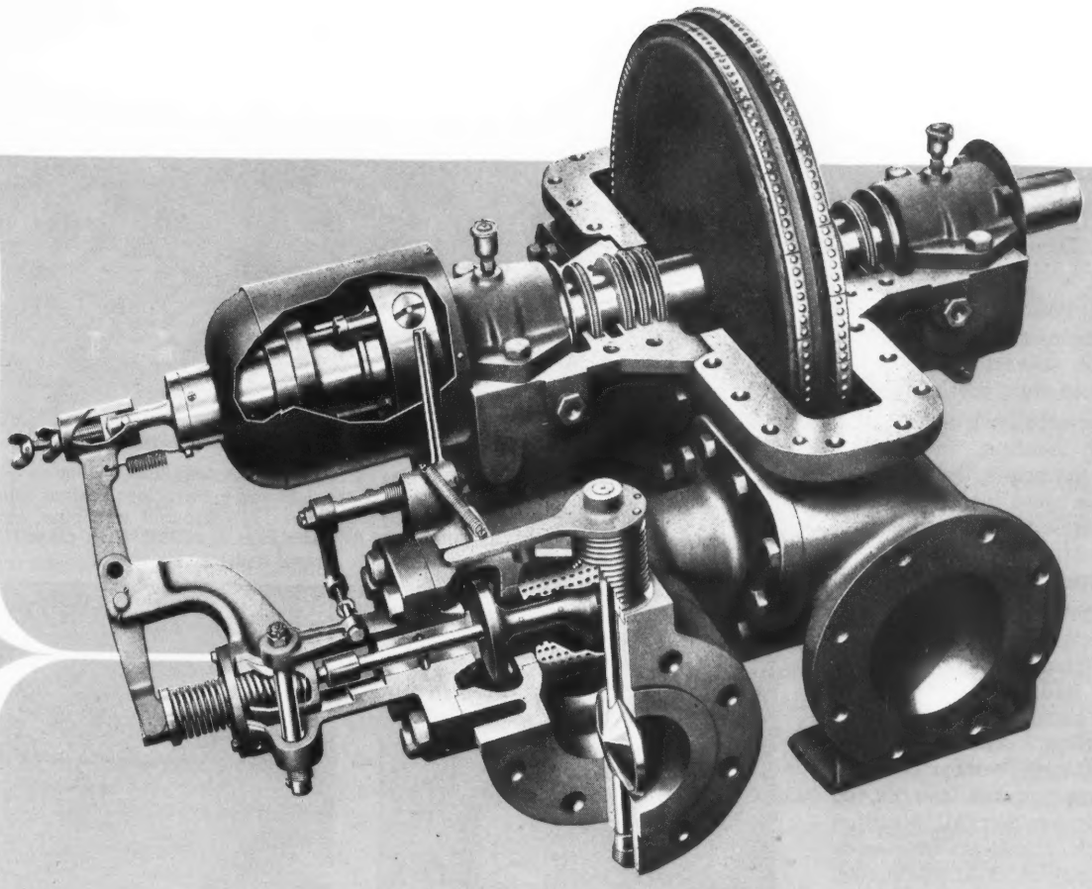

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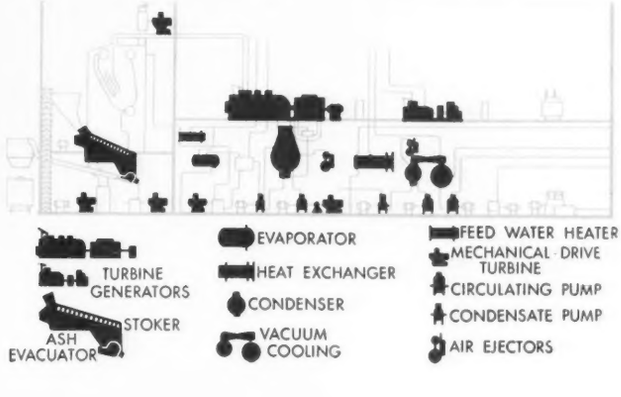


Engineers with new problems are finding answers in RADIANT HEATING

BYERS WROUGHT IRON

The illustration shows one job in progress in a just completed factory addition in an eastern manufacturing plant. The building was 60' x 80', monitor type, and very ingenious use was made of non-critical materials in construction—such as plywood beams and joists. Floor heating coils made up of 1¼" wrought iron pipe, each run resting on a celotex strip placed on the gravel bed.

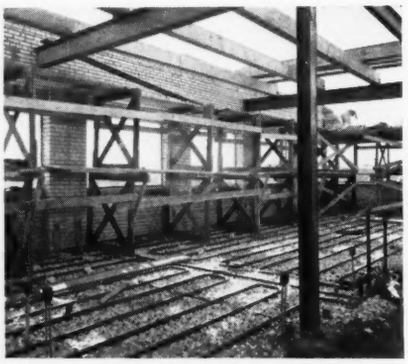
Plant conversion and expansion bring the engineer new problems that can't be solved by old-style thinking or old-style methods.

This is especially true in connection with heating, where the lack of some materials, the shortage of others, the need for speed, and special restrictions due to the particular use of the structure, make past experience and past practice of little value.

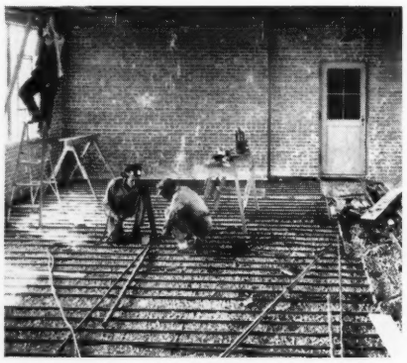
In situations like this, many engineers are finding some welcome answers in Radiant Heating. In addition to a number of installations in plant office, laboratory and similar buildings, Radiant Heating is in progress, on the boards, or projected for an aircraft plant; a hydro-electric plant; an ordnance plant; a control manufacturing plant; and a chemical plant.

This latter installation illustrates the ability of Radiant Heating to meet specialized requirements. The structure housed equipment for fine grinding an inflammable material. Walls, ceiling and floor had to be perfectly smooth, with no windows, projections, ledges or pockets. This of course ruled out any exposed-unit method of heating. Wrought iron coils, imbedded in the concrete floor, answered every need.

Radiant Heating, using wrought iron pipe coils, can be speedily installed. Panels can be fabricated in the shop, and quickly field-assembled. Weights of metal required are considerably less than with conventional hot water or steam systems. And the durability of wrought iron under the service conditions involved is a matter of engineering record.



Of this installation, the president wrote, "Most comfortable building we ever worked in." First year's fuel consumption ran less than half that estimated as necessary for an ordinary installation.



These wrought iron coils are waiting for the concrete topping to be poured . . . which will see the heating installations practically completed. Radiant Heating is particularly adapted to the speed of construction so necessary today.

Our Technical bulletin, "Byers Wrought Iron for Radiant Heating Installations," gives all the information needed for figuring jobs. In addition, our "Experience Pool" built up through cooperation with many engineers on hundreds of installations, is at your service. All you need do is to write.

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Established 1882 • PHILIP W SWAIN, Editor

Why Men Die

Accidents will never cease as long as there are people on this planet, but who can justify the accidental death of 102,500 Americans in 1941 or the ten million injuries, large and small? Who can consider it normal that 40,000 men, women and children were killed by automobiles, 26,000 by falls and about 7000 each by burns and drowning?

Of the 47,000 industrial workers who suffered accidental death last year, 18,000 were killed by occupational accidents and 29,000 by accidents away from the job—the latter predominantly by automobiles and by falls.

Can this terrible record of 1941 be improved in 1942? That will require a supreme effort as far as industry is concerned, because war deals death on the production front as well as on the military. Millions of workers move into unaccustomed jobs. Hours are longer, working pressure higher. Drained of real skills, the labor market offers to industry men utterly without experience or perhaps with a ten-week training course. Plants expand enormously. Overworked managers and supervisors overlook the well-established precautions of peace time.

Unless we vigorously offset these war trends, the *industrial* accidents of 1942 will surely outnumber those of 1941.

Because accidents hamper war production, Donald Nelson is backing the National Safety Council's new drive to establish safety councils in 66 additional cities over 50,000, to extend organized safety from the 25,000 industrial plants that have it now to the far greater number that don't, to make the whole nation safety conscious. W A Irvin, former president of U. S. Steel, is heading a nation-wide drive to raise from leading industries a $5,000,000 "War Production Fund to Conserve Manpower."

Whether as bosses or employees, power men everywhere have a stake in this great campaign against accidents. Power men slip and fall, get hurt handling material and tools, burned by fire and steam, shocked by high voltage, and hit by falling objects. Scores are thus killed every year and thousands injured.

In the public utilities, where safety procedures are highly organized and full records available, about 30 percent of the fatalities and major injuries are caused by improper guarding of equipment, 30 percent by unsafe methods, 24 percent by defective tools and equipment and failure to use protective clothing. On the personal side, 54 percent of all utility accidents are ascribed to disobedience or to other improper attitude toward the job, and 24 percent to lack of experience or skill. Only 20 percent have no contributing personal cause.

Whether the cause be mechanical or personal it stems right back to the chief engineer who hires, trains and supervises the power staff—the man who buys the equipment, controls maintenance, administers discipline and sets the safety standards of his department. Frequent failure of his workers to use available protection reflects on the boss who has obviously failed to make his rules clear to all, enforced and respected.

In times such as these, America *must* spend lives on the field of battle. We can ill afford to throw them away needlessly at home. Industrial accidents must be kept under control if we are to win the battle on the home front.

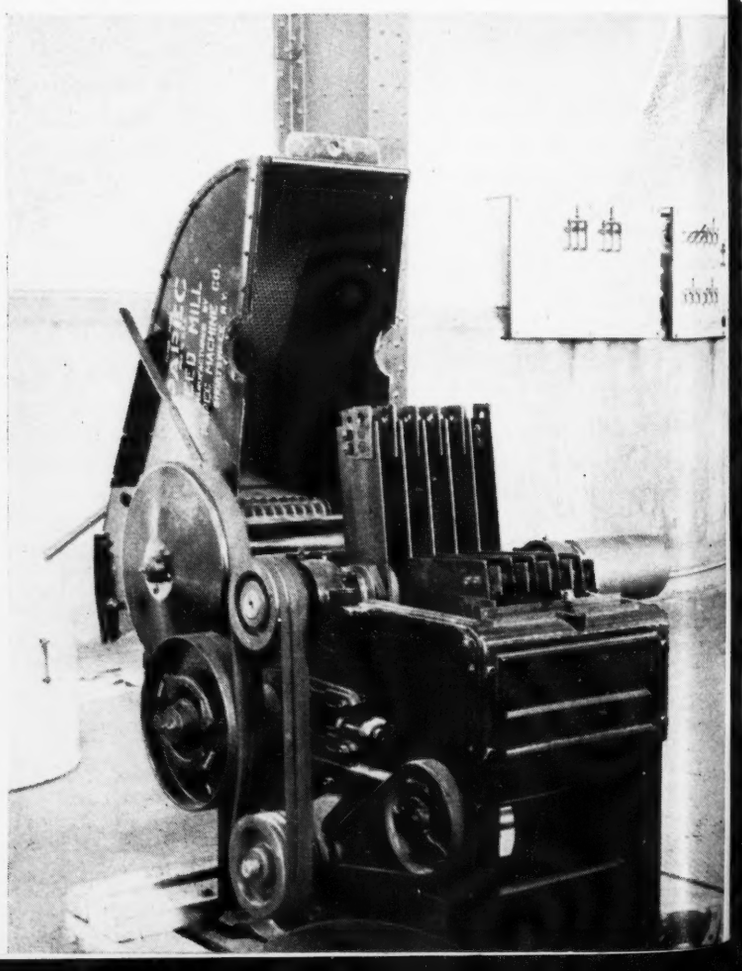
SURPLUS GRAINS FUEL ARGENTINE BOILERS

Successful conversion of steam-generating equipment in Argentine power plants permits use of surplus vegetable fuels. Shelled and cob corn, pulverized barley, bran, sorghum, seedcake and sunflower-seed husks replace imported coal and oil supplies now shut off by the war

Fan and burner combination blows bran through rear furnace wall above the fire to supplement chain-grate firing of shelled corn on four boilers at Santa Fe

Bran and barley storage in the station yard at Puerto Mar del Plata. Where waste fuels must be stored for long periods they are protected by tarpaulins

Barley grinder at Mar del Plata. Bran and pulverized barley are blown directly into the furnace like pulverized coal. A small oil flame aids ignition



▶ WAR CONDITIONS have produced an emergency surplus of many farm products in the Argentine and at the same time a shortage of fuel oil and coal. A program to convert present furnaces to burn excess cereals and wood has been carried out by local power plants in cooperation with the authorities.

While changeover has entailed considerable cost and required ingenuity to obtain efficient combustion of the substitute fuels without smoke, the conversion has proved entirely practical. Several utility plants have completely eliminated the use of coal.

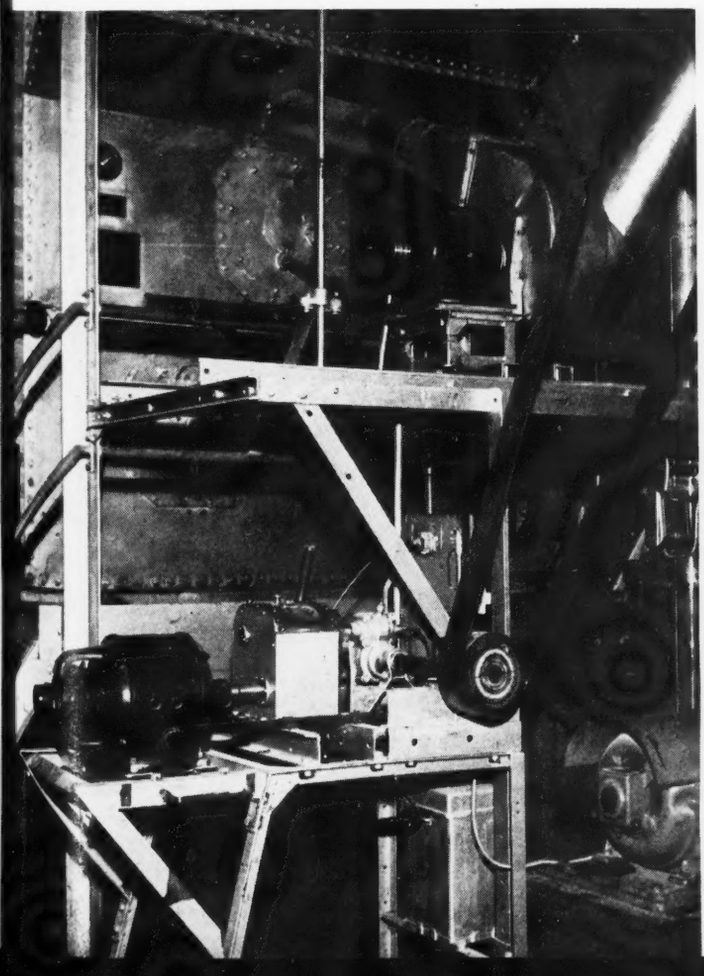
These plants are owned and operated by Argentine utility companies affiliated with American & Foreign Power Co. Ebasco Services, Inc, of New York, are engineering consultants. W A Reece of Buenos Aires is general manager of the Argentine companies; the installations were planned and carried out under the direction of David H Matson, operating manager, and R T de la Serna, chief engineer.

The Calchines plant in Santa Fe has operated entirely on substitute fuels since February of this year. Shelled corn comes to the plant in bags, is carried by a steam crane to an elevator, then transported to the boilers on a traveling belt. From hoppers at each boiler, the corn feeds directly to traveling-grate stokers.

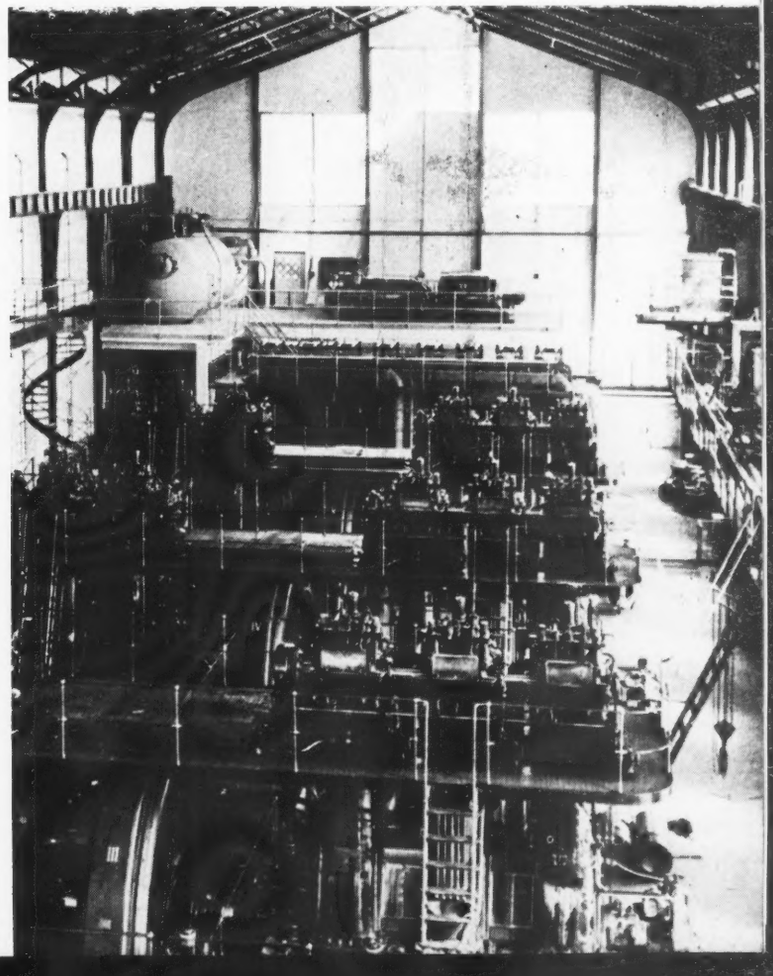
Bran in bags is dumped into hoppers by hand and fed by variable-speed distributors to forced-draft burners at the rear of the corn-burning traveling grate. The combined cereal fuels produce an ash-slag mixture for which no practical use has yet been found.

At first some coal was burned with the corn to obtain full capacity of the boilers. Introduction of supplementary bran burning, however, has eliminated the use of coal completely, with maximum output of the boilers developed at

Shelled corn and bran are received in bags at Calchines plant in Santa Fe. Bran is piled in storage deposit. Corn, principal fuel, now comes directly to plant.



Screw conveyor and bran-feeder system is driven by variable-speed motor through gear-box reducer at Mar del Plata. Note blower and oil burner in background



Diesel-steam combination at Mar del Plata now uses turbine at full capacity for base load. Boiler fires pulverized barley to cut diesel fuel to a minimum

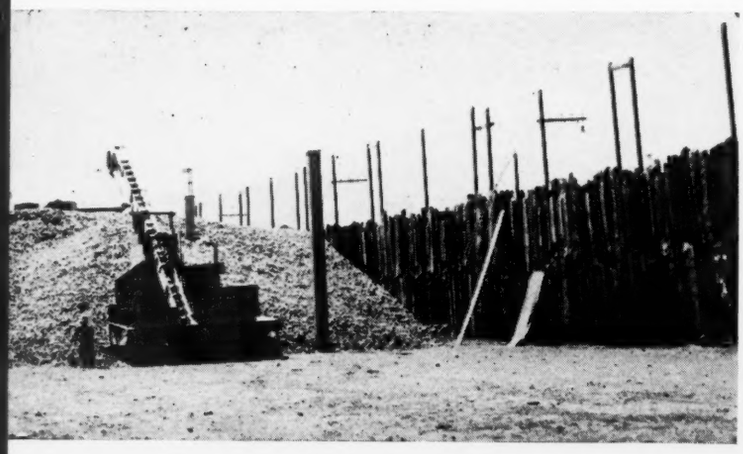
about the same level as previously possible with medium-volatile coal. Ash and soot formation on the exterior of boiler tubes requires an outage of each unit every four days for cleaning.

Bran and barley are the principal substitute fuels available at Mar del Plata. They are burned in a single Babcock & Wilcox integral-furnace boiler originally equipped for fuel oil. Base load for this system is normally carried by diesel units. A 3300-kw Brown Boveri turbine-generator, installed in 1940, was intended for operation as a peak-load unit during the summer vacation season at this seaside resort. Now, to save fuel, the steam unit carries all possible load with substitute fuels while the diesels run only for peak loads.

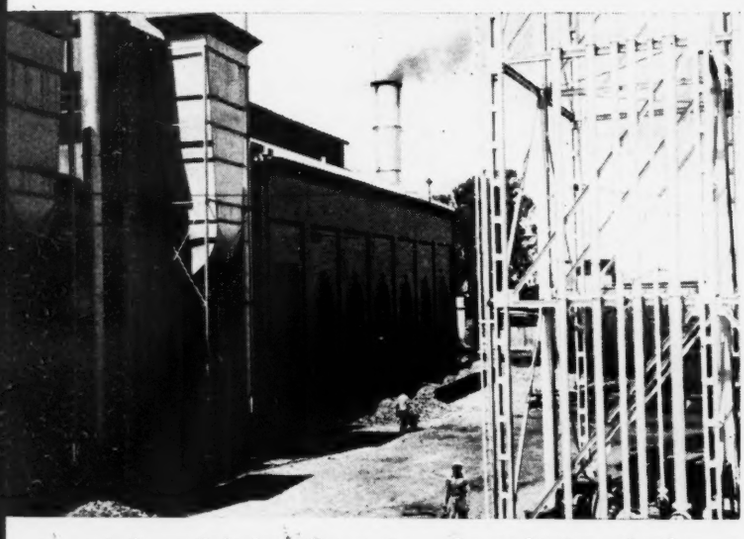
One oil burner remains in service to provide ignition for the bran. Oil to this burner, located as close to the bran burner as possible, has been reduced to a minimum. Slag and ash accumulation on the water-cooled furnace floor is removed while molten through several small holes between floor tubes. Deposits on the boiler tubes are removed mechanically by hand through new lancing doors.

The serious problem of storing bran, barley and sunflower-seed residue has been overcome by building corrugated-iron sheds and by using tarpaulins. Normal daily supply is trucked to plant and bags dumped by hand into feeder hoppers from which the fuel is transported to a loading hopper by an air-transport system or by a bucket elevator. A worm-feed screw supplies the forced-draft burner. Bran is fired as received but barley is ground first.

Corn on the cob, as well as shelled corn and sunflower-seed husks, are burned at Tablada station in Cordoba.

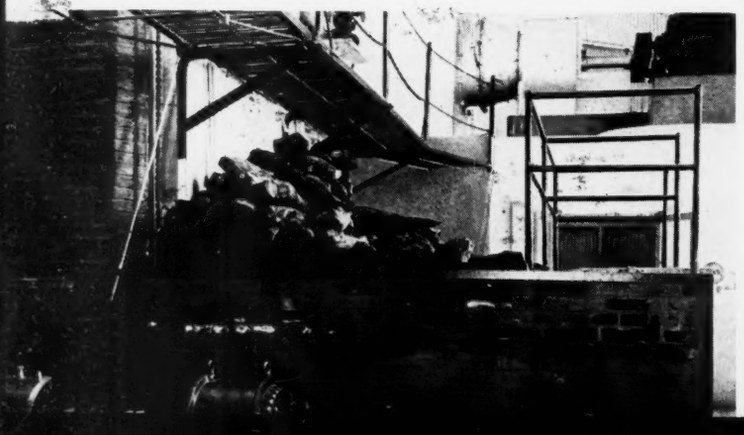


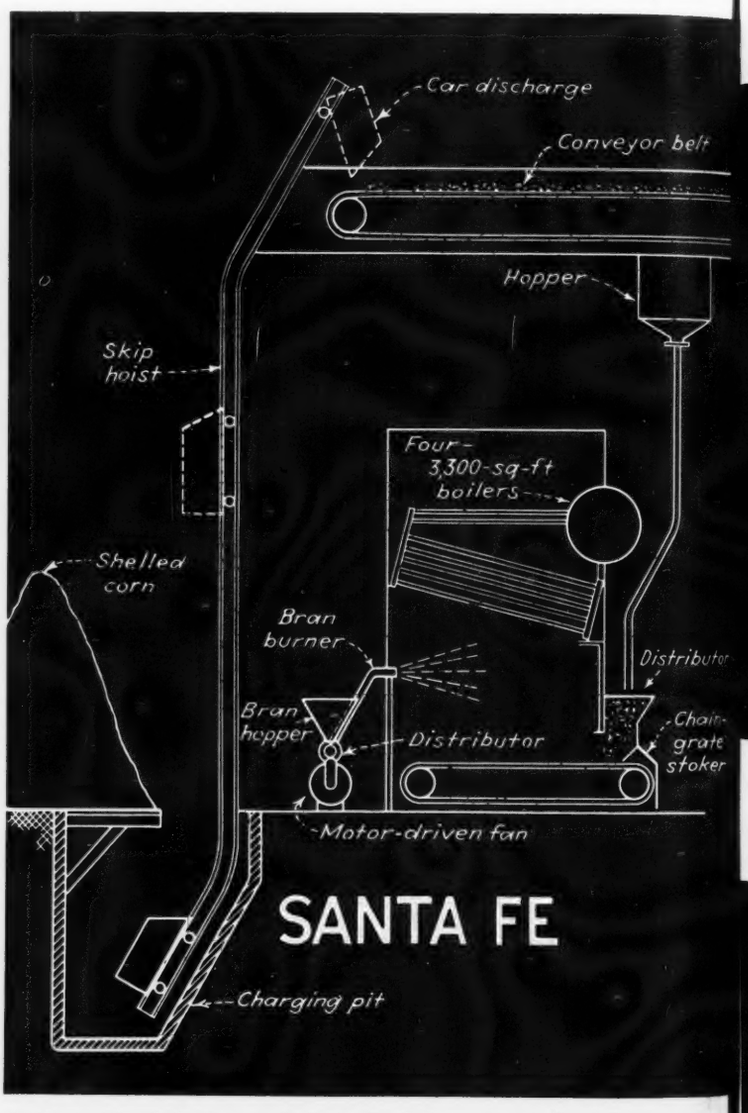
Corn on the cob is stored in a separate yard near the plant at Cordoba. High wooden fence surrounding the yard is equipped with a rat guard. Other fuels, including sun-flower-seed husk, are trucked directly to plant for daily consumption



Corn piled along the exterior wall of plant in Cordoba. Complete cobs are hand fired and secondary air used

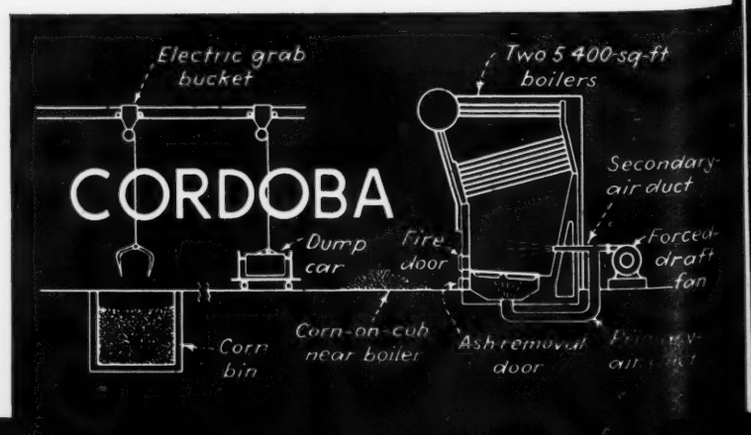
Pre-combustion chamber at Salta permits burning dense local hardwoods in boilers originally equipped for oil





At Santa Fe, shelled corn is burned on a stoker designed for Cardiff coal. *Cia Central Argentina de Electricidad S A*

At Cordoba, corn on the cob is hand fired on stationary grates with forced draft under grate and as secondary air



The three boilers were designed for medium-volatile coal and have an auxiliary overfire-air supply. Addition of fixed blades at the end of the auxiliary-air duct increases turbulence in the furnace and allows burning the substitute fuels without serious smoke.

Hand firing of corn on the cob at the Mendoza station, also in Cordoba, resulted at first in dense smoke and excessive temperature in the superheater as a result of secondary combustion. A new fan supplying secondary air has eliminated the smoking and increased the efficiency.

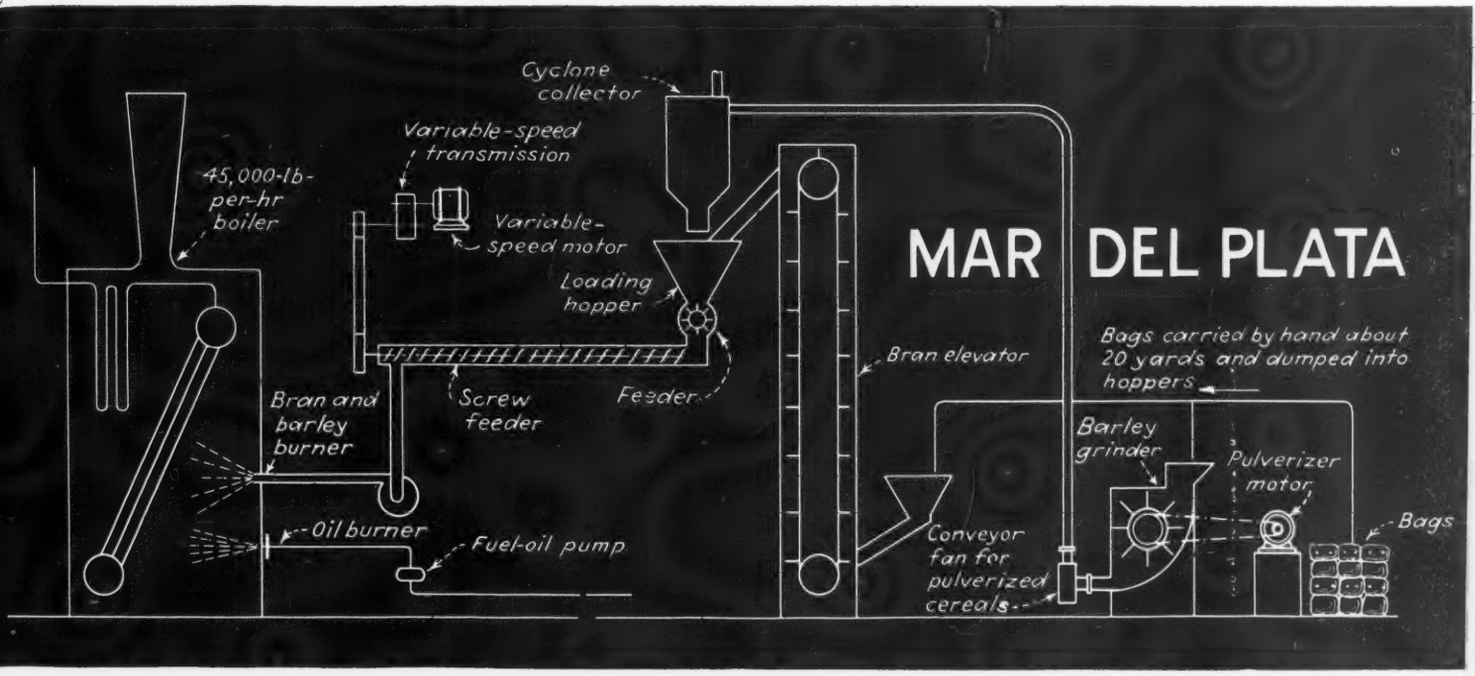
Four boilers at Salta, originally designed for fuel oil, have been equipped with pre-combustion chambers, inclined grates and secondary-air blowers for wood burning. Wood is stored in piles in the plant yard and is loaded by hand on a wagonette. Unloaded close to the pre-combustion chamber, the logs are fed by hand through a door onto the inclined grate.

Base load at Salta is normally carried by diesels. Now, however, the steam-turbine unit runs continuously so that an estimated 77% of the total 1942 kwhr will come from substitutes.

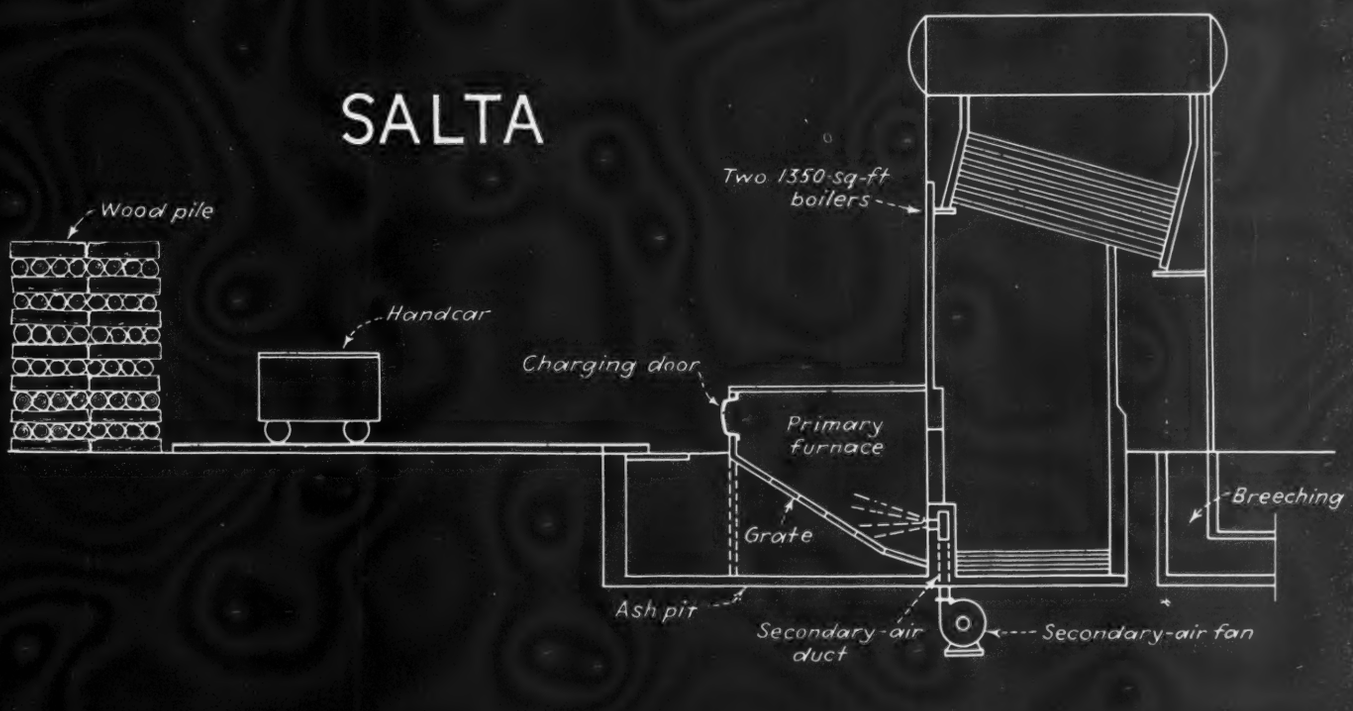
Other plants at Tucuman, Mendoza and Chivilcoy, under the same engineering supervision, have been converted to use substitute fuels. Consumption of coal has been completely eliminated in these stations.

Other plants at Tucuman, Mendoza and Chivilcoy, under the same ownership, and engineering supervision have been converted in a similar manner to utilize substitute fuels. Consumption of coal has been completely eliminated in these stations and the quantity of fuel oil for boiler furnaces and diesels has been materially reduced.

The changeover has been accomplished without seriously disturbing normal operation of the plants and without smoke nuisance of a nature that could not be corrected by secondary air or improved firing methods.



A single large boiler at the summer seaside resort of Mar del Plata fires pulverized barley or bran with only a small oil flame for ignition. Conveying system is mechanized by bucket elevator. ***Cia de Electricidad del Sud Argentino S A***



South American hardwoods can be burned on the inclined grate of this pre-combustion chamber if adequate secondary air is provided. Two boilers equipped for burning wood greatly reduce use of diesel fuel. ***Cia de Electricidad del Norte Argentino S A***

Can Your Motors Carry the Load?

Under today's demands for maximum production it becomes necessary to load motors to their permissible limits. Use this guide to keep you on the safe side when loading your motors

ALAN F LUKENS
Motor Engineering Department
General Electric Co

▶ TWO MAJOR LIMITATIONS dictate what a motor can do without distress. These are its torque ability and the temperature which may be encountered under the installation conditions. A motor is useless if it will not come up to speed, so torque may be considered more important, but because temperature rise of a motor determines how long it is going to last, this is almost equally important. This article points out some of the limitations and gives a rough idea *why* certain limitations have been recognized and standardized by the different AIEE, NEMA, and ASA committees. Table I summarizes the conclusions reached in this discussion.

Nameplate Information

The nameplate on a standard motor states that the unit will deliver a specified horsepower, run at a given speed, and will have a certain temperature rise when operated at rated frequency and voltage, Fig. 2. This can be called the primary rating of the motor and is in effect the guarantee of the motor when operated under ideal conditions. Several secondary ratings are hinted at on the nameplate and tell what the motor will do under other conditions that may be met in actual installations.

On some 60-cycle standard motors, 50 cycles is mentioned and a 50-cycle current is given. This implies that the motor may be operated on 50-cycle lines. A service factor is also given which allows the motor to be slightly overloaded. Supplementing these additional ratings mentioned on the nameplate, normal variations in voltage and frequency can be cared for and special loadings can be carried if the load is intermittent. However, these various departures from the primary ratings cannot be piled one on another without running into trouble.

MODEL	HP	40°C RISE
SERVICE FACTOR 1.15 AT RATED VOLTS, 60 CYCLES		
TYPE CODE	FRAME	SINGLE PHASE
VOLTS		60 CYCLES
60 CY FL AMP	60 CY FL SPEED	
50 CY FL AMP	50 CY FL SPEED	
U S PAT 2085995 2180983	NO.	

Fig. 2—A standard nameplate states that motor will deliver a specified horsepower, run at a given speed and have a certain temperature rise when operated at rated frequency and voltage

The standard guarantee, as listed in the NEMA standards, states in effect that a motor will operate at 10% over or under voltage without injury, but not necessarily with the same char-

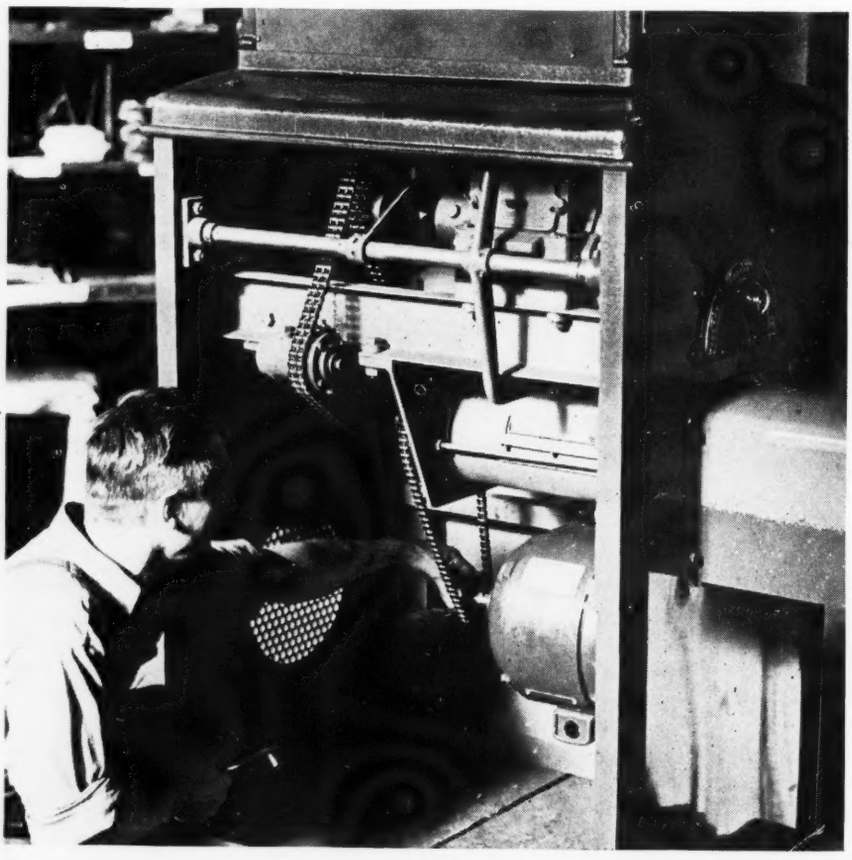


Fig. 1—When motors are built into the machines they drive, the temperature of the air surrounding them may be much higher than room temperature

TABLE I—Operation of 60-Cycle Induction

CONDITIONS			
LOAD	TIME	VOLTS	FREQUENCY
Normal	Cont	Normal	Normal
Normal	Cont	10% high	Normal
Normal	Cont	10% low	Normal
Normal	Cont	Normal	5% high
Normal	Cont	Normal	5% low
Normal	Cont	10% low	5% high
15% high	Cont	Normal	Normal
35% high	Int	Normal	Normal
35% high	Cont	Normal	Normal
Normal	Cont	Normal	50 cycles
15% high	Cont	Normal	50 cycles
35% high	Int	Normal	50 cycles

**All comparisons based on motors at normal load, volts, and cycles.*

acteristics as at rated voltage. Such operating ability is necessary, because line voltages do vary and no motor would be practical if it could not cope with them. However, the starting and maximum torques of a motor vary as the square of the voltage applied, so that a motor connected to a line 10% low in voltage will have only about 80% of the full-voltage torques. This fact must be faced by making proper allowances and selecting a motor with more than enough torque at full voltage, particularly where loads may be hard to start or have high momentary overloads.

If the voltage is higher than normal, the situation is not so critical; the motor will have more than enough torque, but its core losses will increase, its efficiency may be decreased and its temperature may run above normal.

The same NEMA standard also states that a 5% variation in frequency is permissible. In this case, motor torque varies inversely as the square of the frequency, and the current and other factors are affected in much the same way as they are with variations of voltage, but as the inverse squared ratio of frequency. Thus a 60-cycle 220-volt motor on 63 cycles and 198 volts would have a starting torque of only about 75% normal value. This is in general too low for practical use and NEMA standards limit the sum of frequency and voltage changes to 10%.

Electric current passing through a pure inductance varies inversely as the frequency while that passing through a pure resistance is independent of the frequency. Therefore, a motor built up of inductances and resistances only will have more torque on 50 cycles than on 60 cycles. A polyphase induction motor is just such a device and will have something less than 45% more actual pound-feet of torque on 50 cycles than on 60 cycles. This is because the torque varies as the square of the current and the current varies nearly inversely as the frequency, or $(60 \div 50)^2 = 1.44$. Resistance of the motor windings reduces the actual torque to something less than this ideal figure, usually to about 1.35.

In operation, the important thing is the effective torque at the load shaft. If the pulley ratio is changed to compensate for the lower full-load speed of the motor, the effective torque varies roughly as the inverse frequency ratio and will be something less than 1.2 of the 60-cycle torque. Thus a 60-cycle induction motor will have ample torque when operated on 50 cycles but the limitation may be increased temperature. This explains why some motors cannot have the dual-frequency rating.

Full-load current for 50-cycle operation is usually stamped on the nameplate of those 60-cycle motors that carry a 50-cycle rating. The ratio to the 60-cycle current depends on the detailed design of the motor, but it can hardly be less than 5% more. The usual range is from 5 to 35%.

Nameplate Code Letter

NEMA standards and the National Electrical Code have recently been amended to call for a "Code Letter" on the nameplate. This letter specifies the starting kva of the motor at its primary voltage and frequency rating. Table II gives the kva per horsepower as specified by NEMA, and the currents for the most common voltages.

Starting current for other than standard line conditions follows the basic laws already outlined. It varies directly as the voltage, and approximately inversely as the frequency. Thus for the usual 60-to-50-cycle induction motor the code letter applies to the 60-cycle current. When this motor is operated on 50 cycles its current will be nearly 1.2 times the 60-cycle value. This should be remembered in selecting wire sizes and overload protection.

As stated above, an inductance passes current in proportion to the inverse ratio of the frequency. A capacitor acts in just the opposite manner and passes current in direct proportion to the frequency ratio. Thus, a capacitor motor which has both inductances and capacitors in the circuit follows no simple ratios, and the effect of 50-cycle op-

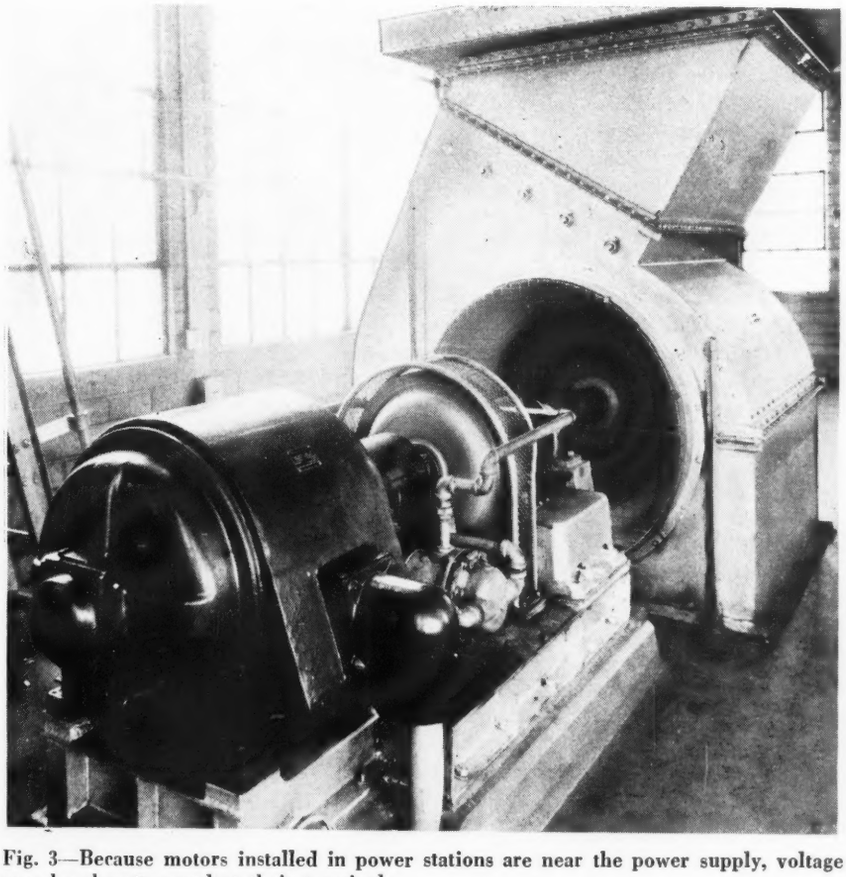


Fig. 3—Because motors installed in power stations are near the power supply, voltage may be above normal at their terminals

Motors Under Various Line and Load Conditions*

	RESULTS		
CURRENT	SPEED	STARTING TORQUE	TEMPERATURE
Normal	Normal	Normal	Normal
Lower	Normal	20% high	Normal or higher
Higher	Normal	20% low	Normal or higher
Small decrease	5% high	7% low	Small change
Higher	5% low	7% high	Higher
Higher	5% high	Too low (75% normal)	Higher
15% high	Small decrease	Normal	50-C rise
35% high	Lower	Normal	50-C rise
35% high	Lower	Normal	Too high (70 C)
Higher	83% normal	35% high	50-C rise
Too high	83% normal	35% high	Too high (60 C)
Too high	83% normal	35% high	Too high (80 C)

eration of a 60-cycle motor is given in Table III. In addition to the electromagnetic effects, the centrifugal switch of a capacitor motor will operate at the wrong percentage of full-load speed when used at other than nameplate frequency. This helps explain why many capacitor motors cannot carry the double-frequency rating.

Standard open motors with class A insulation are rated at a 40-C temperature rise in a 40-C ambient temperature. This adds up to a total observable temperature, by thermometer, of 80 C. The AIEE standards have long listed the maximum or hotspot temperature of the usual class A insulation as 105 C. This total is made up on the basis of a 50-C rise, a 40-C ambient, and a 15-C hotspot allowance. Hotspot allowance covers the difference in temperature between some spot inside the coils and the outside where the thermometer is attached to the winding.

Insulation Life

The latest information on insulation life shows that insulation maintained at 105 C will have a total life of about seven years. However, this is not a common condition, the more usual one being about 30-C ambient, a 40-C rise, and a 15-C hot spot, a total temperature of 85 C. Under this condition the insulation life will be nearly 20 years. This accounts for the fact that many motors have had a life of 20 years or more.

With this background, let's see what the temperature limitation for the secondary ratings actually are. All standard motors carry a service factor which allows the motor to operate at an increased load, and which is primarily intended to care for the uncertainties in determining the exact load that will be applied to a motor. This service factor is usually 1.15. Now the temperature rise of a motor varies roughly as the square of the output, and so a 40-C motor will have a rise of about 50 C when operated at 15% overload. A 50-C rise is considered the maximum safe value in itself for open motors with class A insulation, so the service factor is limited to motor primary frequency.

TABLE III—Effect of 50-Cycle Operation of a 60-Cycle Capacitor Motor

	60-cycle motor on 60 cycles	60-cycle motor on 50 cycles
Locked-rotor torque	100	90
Pull-in torque	100	80
Breakdown torque	100	110

TABLE II—Starting KVA Input Per HP at Rated Voltage and Frequency

CODE LETTER	MAXIMUM	MAXIMUM AMP, 1 PHASE, 230 VOLTS	MAXIMUM AMP, 3 PHASE, 220 VOLTS
A	3.14	13.6	8.2
B	3.54	15.4	9.3
C	3.99	17.4	10.5
D	4.49	19.5	11.8
E	4.99	21.7	13.1
F	5.59	24.3	14.7
G	6.29	27.4	16.5
H	7.09	30.8	18.6
J	7.99	34.7	21.0
K	8.99	39.1	23.6
L	9.99	43.4	26.2
M	11.19	48.6	29.3
N	12.49	54.2	32.7
P	13.99	60.8	36.6

A 60-cycle motor on 50 cycles, and at full load, will have its temperature rise increased from the rated 40 to about 50 C because of the lowered efficiency and because the fan action is reduced by the lower full load speed. A 50-C rise is considered a safe value provided it is limited to full load.

Now suppose the two secondary ratings are superimposed one on the other. The temperature rise would then be about 60 C, and with the usual hotspot allowance and a 30-C ambient, the total temperature is 105 C. This will reduce the insulation life to nearly one third of its usual value, or from 20 to 7 years. If the ambient is not 30 C but approaches 40 C, insulation life again is cut in half, or to 3.5 years. 40 C is only 104 F and is of course not at all an impossible value for an ambient, especially in the south and west. In addition, the present trend to enclosing motors in machine bases makes the temperature of the motor-cooling air much greater than the room temperature. For these reasons the danger of applying a motor at its service factor load on 50 cycles is clearly seen.

Intermittent Loads

Motors are often called upon to deliver well over the nameplate horsepower on intermittent loads. This is perfectly valid provided it is done properly. For example, consider the usual refrigeration service factor of 1.35 for the 1-hp size. The usual refrigeration load requires the motor to run about 50% of the time when the box is working at capacity. Since, a motor at standstill can dissipate heat only about one half as fast as when it is running at no load and the temperature rise varies with the square of the output, the equivalent heating load is about 1.1 hp, and the temperature rise is about 49 C for a 40-C motor. This is satisfactory when the motor is operated at its given frequency, but it is too much for the motor when operated on 50 cycles.

Naturally, there are many cases where motors have been applied beyond the limitations outlined above and with evident success. However, the life of the insulation has definitely been shortened and trouble will be experienced before long. Such short life often does not appear on the records.

Overload Devices

Because these abuses are hard to segregate and control, motors equipped with some type of automatic-reset overload device are becoming more and more popular. In these motors the overload device controls the loading of the motor on the basis of temperature and current. If the motor is called upon to carry more load than the designer anticipated, the overload device trips it from the line and prevents restarting until it has cooled to a safe temperature. The use of a motor with such a built-in overload device may pinch some users when they change from motors without any, but it is a clear indication of improper loading in the first place and of ultimate trouble.

The well deserved reputation for reliability held by electric motors has been acquired throughout the years because the limitations outlined have been conservatively followed. On the other hand, it is especially important under today's conditions to utilize motors to their permissible limits. An understanding of these supplementary rating abilities of motors will permit a more intelligent use of the full capabilities of motors without jeopardizing continuity of operation, thus effecting a conservation of vital materials and motor production.

Maintenance Hints for Industrial Lighting

Greater efficiency, better performance result from a planned maintenance program for incandescent and fluorescent lamps. Here are suggested ways to improve light output

▶ BETTER PERFORMANCE and greater efficiency at lower operating costs are the direct benefits of a complete inspection and well-organized maintenance program for industrial fluorescent and incandescent lighting. In addition, materials on the critical list, such as aluminum, copper, bronze and nickel are conserved and the normal life of the fixtures is increased substantially, according to Westinghouse engineers.

Luminaires should be cleaned frequently. If dirt is allowed to accumulate on reflecting surfaces and lamps, illumination may be reduced 30 to 50% in a short time. For maximum efficiency, reflectors should be thoroughly cleaned with soap and water. When concentrating high-bay reflectors are used, dirt not only reduces total light output, but alters light distribution. For example, the efficiency of an aluminum high-bay reflector was reduced 42% by dirt, and the candlepower was reduced 66% because the distribution was changed. Therefore, illumination on the working plane was reduced 48%. Dirty reflectors, lenses and lamps may be cleaned easily with non-abrasive soap.

When lamps fail they should be replaced immediately with the proper size and style bulb. In large plants the most effective method is to have a relamping crew patrol the plant regularly. With a properly planned system, the lost lumen hours and cost of relamping are kept to a minimum. When fluorescent units are used, the lamp fails when emission material on the electrode is used up. At this time the lamp will flash on and off and must be replaced promptly to protect the starter and ballast. Additional information on relamping schedules, etc, will be published in a later issue of POWER.

Operate at Rated Voltage

For most efficient lighting with filament lamps the luminaires should operate at rated voltage marked on the bulb. Socket voltage below rated value will reduce light output about three percent for every one percent of voltage reduction. High voltage will increase light output and lumens per watt, but will affect the lamp life adversely.

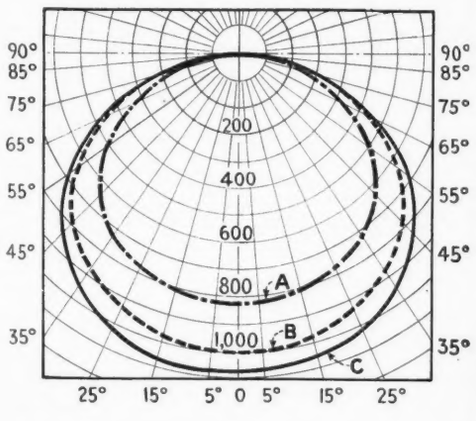
Rating of a fluorescent luminaire is marked on the nameplate and ballast and voltage should be kept at the center of the specified range. Both high and low voltage lower fluorescent lamp life and may cause starting difficulties and arc instability.

Blackened and over-age lamps waste current and lower light output. Worn or frayed wiring can cause circuit failures. Therefore, regular cleaning and wire inspection schedules should be planned, and lamps that have passed their normal rated life should be replaced. Poor connections, faulty safety devices and mounting fixtures should be repaired promptly.

Fig. 1—Cleaning reflectors or lenses at scheduled intervals improves efficiency of industrial lighting equipment, is vitally important where smoke and soot are heavy

Fig. 2—Immediate replacement of fluorescent tubes that are burned out or beyond normal operating life insures economical and efficient operation of the lighting system

Fig. 3—Effect of dirt on reflector, efficiency is shown on this chart, made from measurements taken on a fluorescent luminaire installed in a machine shop. The unit had not been cleaned for 12 months. Curve *A* shows an efficiency reduction from 79% (when clean) down to 61%. Dry wiping brought the efficiency up to 74% (curve *B*) and soap and water increased the output to 79%



How to Design Better Diesel Plants

Make full use of heat recovery and give careful thought to building layout and selection of mechanical and electrical equipment say engineers at 15th Oil and Gas Power Conference

▶ IF CORRECTLY APPLIED, heat recovery pays for itself much faster than the engine does, according to F P Grutzner, Fairbanks, Morse & Co. Speaking to members of the Oil and Gas Power Division, ASME, and of the Diesel-Engine Activity, SAE, at the 15th National Oil and Gas Power Conference held at Peoria, June 17–19, Mr Grutzner outlined methods used to figure heat recoverable in diesel installations, described equipment and controls for various applications, and cited cases where heat recovery boosted thermal efficiency to 75–85%.

By means of carefully made factory tests, manufacturers develop heat-balance data like that in Fig. 1, for various types of engines. These curves form the starting point for any heat-recovery study. Normally all heat in jacket water and lube oil can be recovered; as a matter of fact, if the heat cannot be used, means must be provided for disposing of it so that the engine will be cooled properly. Up to about 60% of the exhaust heat can be recovered in practical applications.

Because the largest percentage of the heat is in the cooling water, the heat-recovery analysis of a plant begins with an investigation of hot-water requirements, for process or service. After that, remaining heat can be used to supply part of the winter heating load. In all studies of this kind, it is important to check the availability of waste heat against the demand; based on engine loads, a "heat available" curve can be plotted and compared with a "heat demand" curve. This should be done on a daily and a yearly basis.

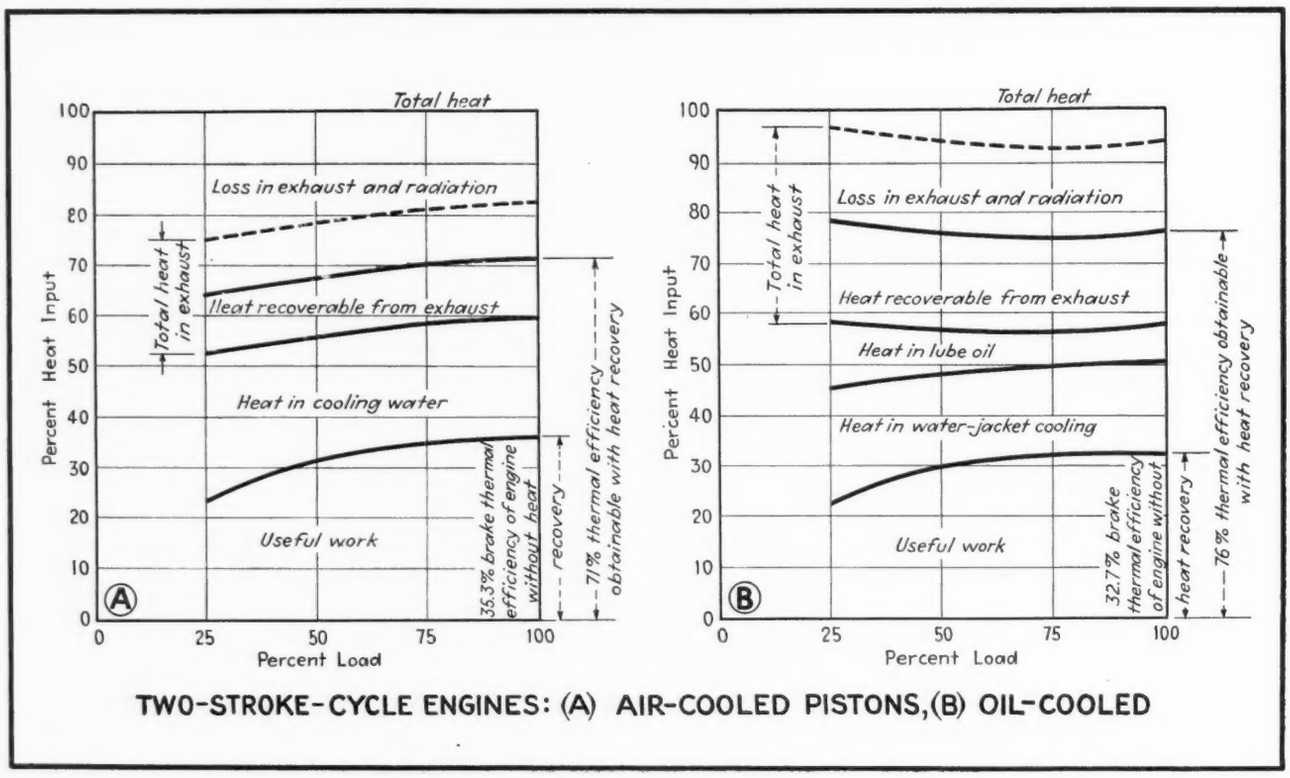
Typical Hookups

Fig. 2 shows four typical basic hookups for heat recovery; in all cases the oil coolers, heat exchangers and radiators for oil and water are standard commercial types. The exhaust heater or boiler should be designed as a silencer and it should be possible to drain it in summer and operate dry. Resistance to passage of exhaust gas should not be more than that of a silencer.

Mr Grutzner described application of heat recovery to a 40-hp 4-cycle diesel-generator set in a Chicago store; hot water made from jacket and exhaust heat is used for both washing and store heating. The plant is all automatic, being started and stopped by the store manager and visited periodically by a service man. On the basis of average monthly operating costs, including fuel oil, lubrication, maintenance, labor and utility standby, but not depreciation, cost per kwhr runs $0.0132. Giving the engine credit for hot water formerly made with gas and for space heating formerly done with coal brings the average cost per kwhr down to $0.0055, for the winter months only. Savings from heat recovery reduced the time needed to pay for the installation out of savings from four to 2.9 years. Overall thermal efficiency ranges up to 85%.

Highest economy follows when the diesel-engine power plant, with heat recovery, is planned as an integral part of the whole industrial operation as is the case with the complete cotton-gin installation shown in Fig. 3. Air transports the cotton and heat drys it. The

Fig. 1—Typical heat-balance curves for single-acting two-stroke-cycle diesel engines



TWO-STROKE-CYCLE ENGINES: (A) AIR-COOLED PISTONS, (B) OIL-COOLED

air moves from outside through a screen to the fan, then through the jacket-water radiator to the exhaust heater, through an additional oil burner to the cotton gin and out to the atmosphere. The auxiliary oil burner takes care of varying loads and temperatures and is automatically controlled. The heat exchanger proper, including the auxiliary oil burner and all automatic equipment, is mounted together as a unit (see detail) and requires only exhaust, jacket-water, and air connections.

In actual cases, engine cooling must always be the first consideration, with heat recovery second. If the heat recovered from the diesel engine satisfies a base need and an additional heating plant is needed to make up the difference, this additional plant can take care of variations in heat demand. This arrangement gives maximum benefit from heat recovery and a simple regulating system.

Heat-Recovery Control

If the heat generated in the engine is at times greater than the heat demand, the heat regained may have to be all or partly bypassed. Fig. 4 shows automatic controls for operating dampers on a radiator and fan installation; the thermostatically controlled dampers divert the warm air outside when it is not wanted in the building.

The output of a low-pressure steam boiler in the exhaust line may be partly regulated by varying boiler water level, as shown in Fig. 4. By-passing the boiler is not often applied because of the large piping involved and the difficult conditions under which valve equipment must operate. In many cases, installation of a large water storage tank will absorb differences between heat use and generation and simplify the control problem.

Power plants built for central-station service must be designed so that additions or alterations can be made without

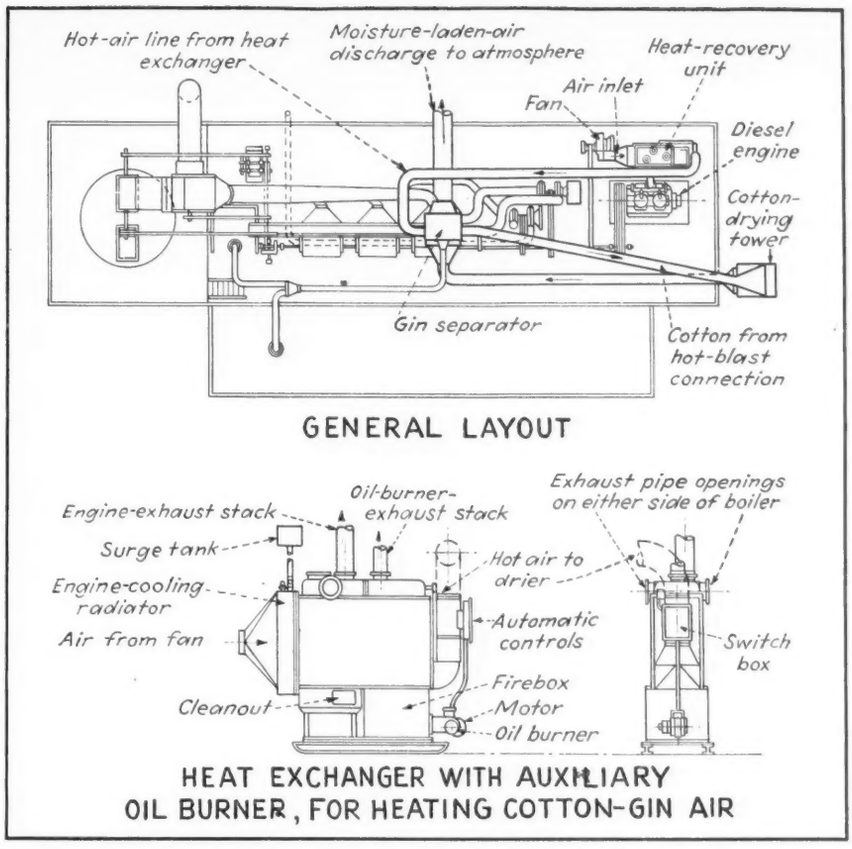
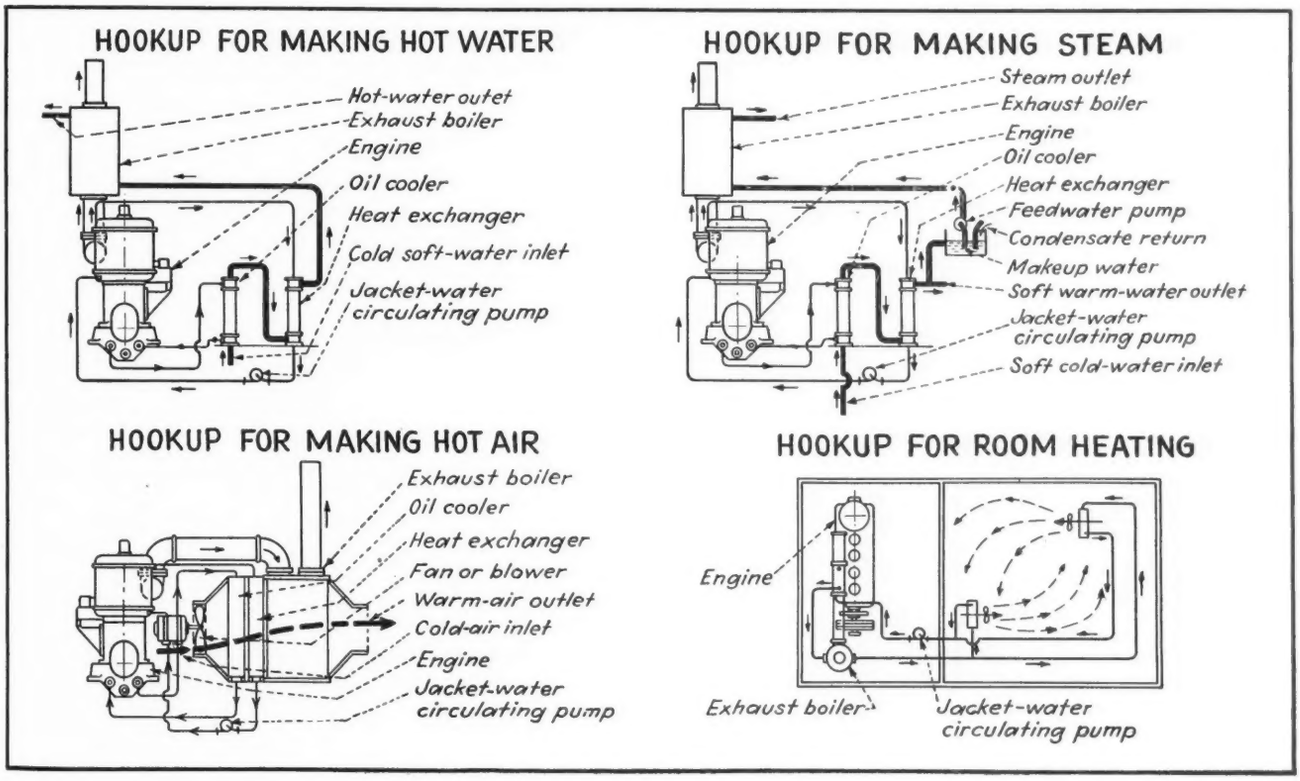
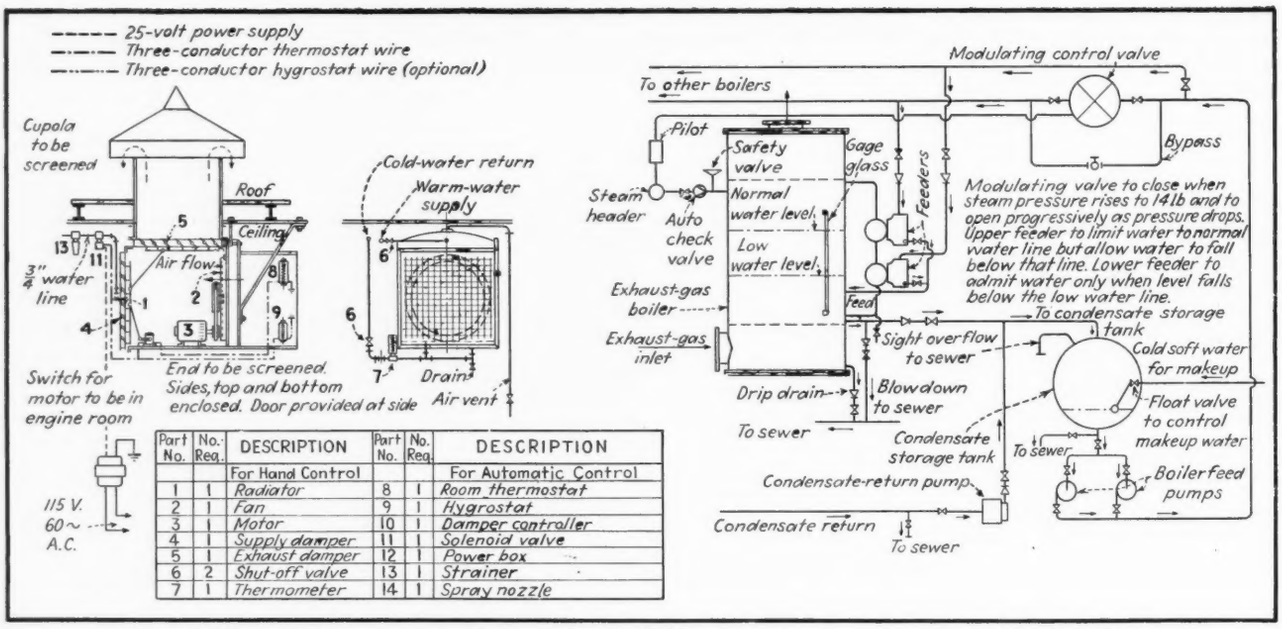


Fig. 3—Diesel-driven cotton gin with integral heat-recovery equipment

Fig. 2—Four basic hookups for heat recovery—making hot water, low-pressure steam, or hot air, and space heating with hot water




25-volt power supply
Three-conductor thermostat wire
Three-conductor hygrostat wire (optional)
Cupola to be screened
Roof
Ceiling
Air flow
3/4" water line
Switch for motor to be in engine room
End to be screened. Sides, top and bottom enclosed. Door provided at side
Cold-water return
Warm-water supply
Drain
Air vent
115 V. 60~ A.C.
To other boilers
Modulating control valve
Pilot
Safety valve
Gage glass
Feeders
Steam header
Auto check valve
Normal water level
Low water level
Bypass
Modulating valve to close when steam pressure rises to 14 lb and to open progressively as pressure drops. Upper feeder to limit water to normal water line but allow water to fall below that line. Lower feeder to admit water only when level falls below the low water line.
Exhaust-gas boiler
Exhaust-gas inlet
feed
To condensate storage tank
Cold soft water for makeup
Sight overflow to sewer
Blowdown to sewer
Drip drain
To sewer
Condensate storage tank
Float valve to control makeup water
Boiler feed pumps
Condensate-return pump
Condensate return
To sewer

Part No.	No. Req.	DESCRIPTION	Part No.	No. Req.	DESCRIPTION
		For Hand Control			For Automatic Control
1	1	Radiator	8	1	Room thermostat
2	1	Fan	9	1	Hygrostat
3	1	Motor	10	1	Damper controller
4	1	Supply damper	11	1	Solenoid valve
5	1	Exhaust damper	12	1	Power box
6	2	Shut-off valve	13	1	Strainer
7	1	Thermometer	14	1	Spray nozzle

Fig. 4 Two control arrangements for use when available engine heat exceeds process demand at times

tearing down the entire existing structure, according to Glenn C Boyer, Burns & McDonnell Engineering Co, who presented a practical paper on "Design of Internal-Combustion-Engine Power Plants." Need for flexibility in plant layout, he pointed out, dictates the kind of material used. Experience indicates that any building that must be extended or altered is best constructed with a reinforced-concrete substructure carrying a brick and steel superstructure. Figs. 5 and 6 show a building designed with cantilever floor slabs and a rigid-frame structure, permitting great layout flexibility, and giving the necessary stiffness in a brick building. Reinforced-concrete structures are naturally rigid; precautions must be taken to eliminate possibility of concrete destruction from engine vibration.

Pump Selection

By working out an actual case in some detail, Mr Boyer stressed the importance of selection of suitable head-capacity characteristics for centrifugal pumps and proportioning pipe sizes to obtain an economical balance between fixed charges and additional power costs. In general, it will be found that for most power plants it is wise to use too-large rather than too-small pipe diameters in the cooling system and to provide a safe margin of safety for pipe fouling and increases in plant capacity beyond original plans.

Discussing air intake and exhaust systems, Mr Boyer pointed out that two-stroke-cycle engines may set up airborne vibrations which can be reduced or eliminated by installation of intake mufflers, provision of a suitable plenum chamber between air filters and engine, or by use of venturi nozzles in the entrance of air-intake pipes. Although suitable muffling equipment is available and commonly used, construction from engine to muffler has not been standardized. In planning exhaust conduit or piping from engine to muffler, suitable provision must be made for expansion. Failure to make such provision in an underfloor concrete exhaust duct may cause serious damage to the engine and generator foundation block.

A major part of Mr Boyer's paper covered the rating of electrical generators and the selection of proper oil circuit breakers. Discussing the temperature rating of generators, Mr Boyer outlined the conditions under which 40-C-rise machines are used and pointed out that the ability of such units to deliver 125% of rated capacity for two hours with a 55-C temperature rise when ambient air is 40 C may offset the added cost compared to 50-C-rise units. Occasionally an operator insists on purchasing an alternator designed for power factors ranging from 60 to 70%, hoping thereby to eliminate some of the operating difficulties experienced with derating alternators designed for 80% pf when system pf is less than 80%. The answer lies in improving the power factor of the load rather than attempting to operate generators at power factors lower than 80%.

Mr Boyer pointed out that altitude above sea level influences alternator capacity: basic designs for 50-C-rise machines are satisfactory for full load operation at elevations up to 3300 ft above sea level; elevations above 3300 ft require modifications at increased cost. Generators rated for 40-C rise are satisfactory for full-load operation up to and including 9900 ft above sea level although carrying no overload guarantees above 3300 ft.

Circuit breakers must successfully interrupt the maximum kva that they will be called upon to handle and in addition must possess sufficient mechanical strength to withstand the initial current inrush during a short circuit. "Decrement curves" have been developed to give the current flow for machines of various reactances and for various periods of time following the start of the short circuit. Two examples were cited showing the use of these curves for a single generator and for several machines connected to the bus.

Electrical Control

Electrical control for auxiliaries in the power plant should be simple, rugged and dependable. Because the circulating-water pumps are the most essential plant auxiliaries, it is necessary to insure that they will operate whenever the engine is running. Thus control equipment for starting and stopping pumps must be as nearly foolproof as possible. Mr Boyer cited the use of low-voltage manual air circuit breakers from which thermal-trip elements have been removed. With only magnetic-trip elements left, continuity of motor operation is assured under all conditions except a dead short in the motor or its power-supply leads.

Other papers of interest to power engineers are summarized on pg 75. Papers and discussions will be issued later in the form of Proceedings, which can be obtained from the American Society of Mechanical Engineers, 29 West 39th St, New York, N. Y. ($1.00 to members, $1.25 to non-members).

Power Pulsations Between Synchronous Generators, *by Troels Warming, Mechanical Engineer, Nordberg Mfg Co, Milwaukee, Wis.*

Gives a graphical method for finding the natural frequency of any number of generators running in parallel. An estimate is made of the unbalanced torque which may be expected from an internal-combustion engine and based on this the power pulsation is computed. A simple formula is given for the case of only two generators in parallel and the paper shows how a system of several generators may be reduced to an equivalent system of two. By means of an example involving three generators the influence of damping on a vibrating system of this kind is shown.

Bearings for Diesel Engines, *by Albert B Willi, Chief Engineer, Federal-Mogul Corp, Detroit, Mich.*

Outlines the field of usefulness of various bearing materials and shows, by charts and tabulations, that materials applied within their defined field of usefulness will show or can be made to show satisfactory performance. Discusses substitute materials and shows how they compare with respect to friction and wear, temperature, life, bond strength and other physical properties. Stresses importance of lubrication and points out that surface discoloration, sometimes a symptom of corrosion, causes discard of many perfectly good bearings. Describes and classifies kinds of surface discoloration, indicates causes, discusses diagnosis of condition, and suggests remedies.

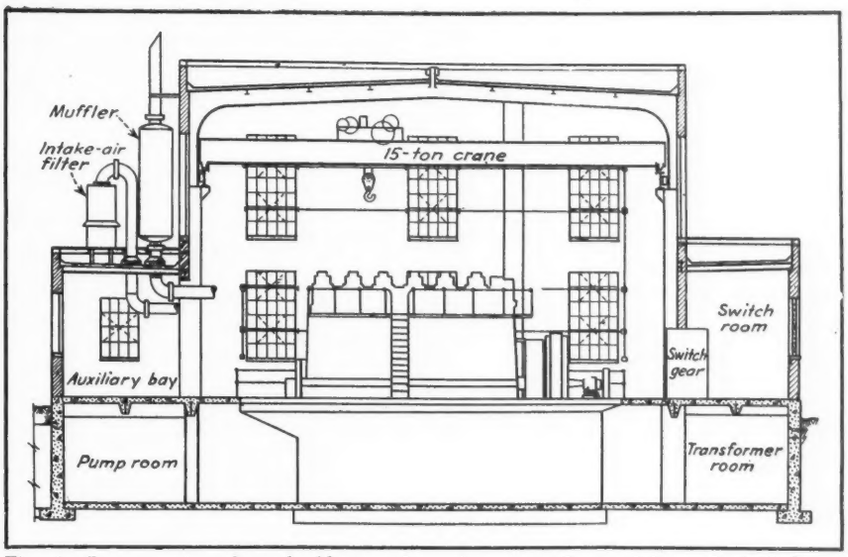


Fig. 6—Cross section through Algona plant shows cantilever slabs and rigid frame

Load Relations in Bolted Joints, *by Thomas J Dolan, Assoc Prof of Theoretical and Applied Mechanics, University of Illinois*

Presents equations for distribution of loads and deformations in a bolted assembly and for total loads carried by the bolt for the case in which the bolt is subject to axial loads only. Initial bolt tension must be set high enough to obtain a good factor of safety against opening of the joint but the bolt tension must be kept as low as possible so that the bolt will carry service loads without yielding and can withstand the fluctuations of load without developing fatigue fracture. The paper contains several charts which simplify the analysis of conditions in bolted joints and suggestions for solving bolting problems.

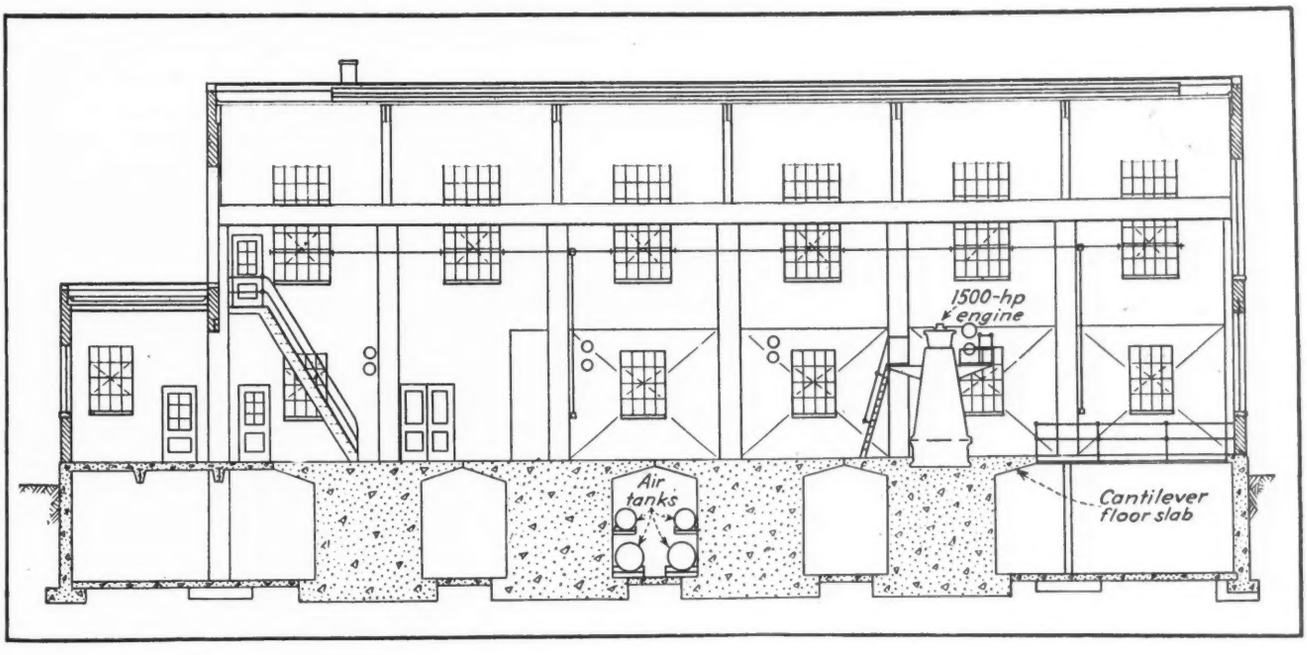
The Positive-Displacement Supercharger, *by John L Ryde, McCulloch Engineering Co, Milwaukee, Wis.*

Discusses performance of positive-displacement supercharging blowers in some detail, also scavenging, intercooling, blower design and noise, and stresses need for a better air compressor to meet size, weight and cost requirements of supercharging.

Instrumentation in the Study of Diesel Combustion, *by E W Landen, Armour Research Foundation, and L A Blanc, Caterpillar Tractor Co*

Describes technique for optical study of combustion in actual engine cylinders by means of quartz "window" and spectograph or high-speed camera and also technique of measuring pressure.

Fig. 5—Longitudinal section through Algona diesel plant (see POWER, Nov 1941) shows cantilever floor slabs



Modern Turbine-Driven Units Fit Variable-Load Pumping Systems

Roy Carter, application engineer, Worthington Pump & Machinery Corp, describes self-contained steam-turbine centrifugal pumping units in waterworks and shows how auxiliary hookups are varied to meet local conditions with minimum first cost and maximum efficiency

▶ MODERN SELF-CONTAINED steam-turbine-driven centrifugal pumping units, complete with condensers and auxiliaries, offer substantial advantages for waterworks service, including space saving and a high degree of flexibility in meeting local conditions. Particularly where moderization of steam pumping stations is involved, they rank with the more publicized diesel-engine-driven installations and the generally accepted motor-driven units.

Typical recent installations illustrate the design refinements incorporated in today's steam-turbine centrifugal pumps and show how general arrangement and auxiliary hookups can be fitted to local needs. A 1245-hp unit, Fig. 2, recently installed at the New Milford pumping station of the Hackensack Water Co, Oradell, N. J. has, among other features, automatic nozzle control for the turbine to take care of wide load variation. The 310-ft pumping head required a series pump and space limitations made it necessary to close-couple the two stages, using a common shaft for the two impellers.

The steam turbine of the Hackensack unit exhausts into a power-plant-type two-pass surface condenser. A separate circulating pump, driven by an extension of the main-pump shaft, circulates water through the condenser. Water is taken from the suction line supplying the main pump and discharged into the suction pipe near the main pump, Fig. 3. Head developed by the circulating pump is low, being equal to that necessary to cause water to flow through the condenser and its connected piping.

Use of power-plant condensers distinguishes these modern units from the older types which utilized the so-called "waterworks" condensers in which steam is condensed in the tubes and the entire water flow to the pump passes through the shell of the condenser outside the tubes. During the last 10 years all installations known to the writer have used power-plant condensers because they provide a more economical unit to operate.

Water Passes in Condenser

When the suction lift permits, and the ratio of water quantity to steam flow warrants, single-pass condensers connect to the pump suction line and the entire water flow serves as circulating water, Fig. 4. As this arrangement increases the suction lift on the main pump, necessitating low head loss, the condensers usually have short tubes, often having a diameter of one inch or larger.

In most installations a multi-pass condenser with a separate circulating pump, driven from the main pump shaft, is more economical, Fig. 3. With either type, power required for circulating through the condenser is supplied by the main steam turbine, which has a good water rate. A separately driven circulating pump, using a small steam turbine, an electric motor, or a water turbine, would be less efficient and cannot be justified except for unusual local conditions.

Condenser auxiliaries usually include a steam-jet air ejector and a centrifugal condensate pump. For small units a direct-acting steam-driven wet vacuum pump proves more economical in spite of the poorer vacuum obtained. As wet vacuum pumps operate best against a

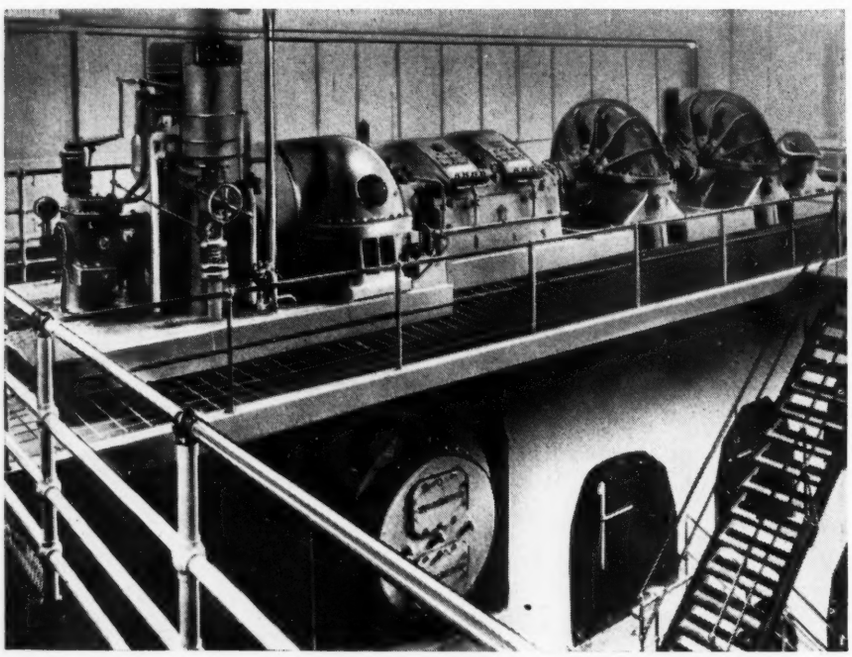


Fig. 1—A 2500-hp steam turbine geared to a 25,000,000-gpm centrifugal pumping unit with separate condenser circulating-water pump

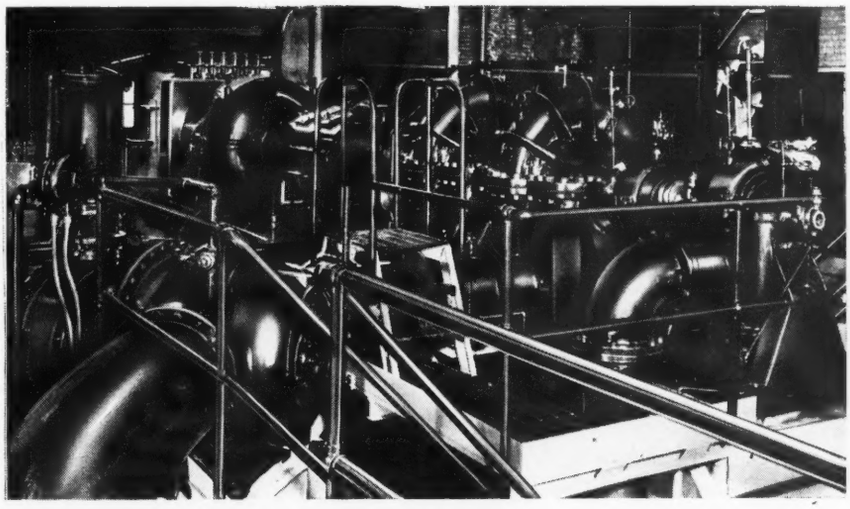


Fig. 2—At New Milford pumping station a 1245-hp steam turbine drives a double-impeller centrifugal pumping unit with separate condenser circulating-water pump, coupled to the main shaft, and a water-turbine-driven condensate pump

low discharge head, it is better to have them discharge into an adjacent tank and allow the air to separate out. Condensate is pumped away by some other means. A regular condensate-return unit with a vented receiver can be used advantageously for such an installation. In a few small installations water-jet ejectors or eductors, using water from the main pump discharge as a power water source remove air or condensate, or both. Some doubt exists as to how wear in these water-jet ejectors or eductors affects operation of the unit. Experience indicates that steam-driven direct-acting wet vacuum pumps are more economical for small horsepower units than water-jet equipment and therefore form the proper choice.

Steam-Jet Air Injectors

Steam-jet air ejectors for this equipment are two-stage units with inter- and aftercoolers to condense the steam used. Where units are of sufficient size, condensate forms the cooling medium in the ejector inter- and aftercooler. Where condensate is not sufficient, recirculation can be arranged or raw water used. To insure continuous operation, duplex ejectors are generally used. Condensate from the ejector inter- and aftercoolers drains to the condensers through traps or similar devices, and is removed with the condensate by the pump.

A centrifugal pump driven by a water turbine constitutes the usual condensate-removal unit. Water for driving the turbine comes from the main pump discharge and returns to the suction line, Figs. 3 and 4. Construction details of such units vary considerably with the several manufacturers and with operating conditions for both condensate pumps and turbines. It is therefore not advisable to consider the construction used for any one installation as typical for all.

These steam-turbine-driven pumping units generally discharge directly into the water mains in which the demand, and sometimes the head, varies throughout the day. Because the speed of the unit can be adjusted either manually or automatically by adjusting the turbine governor, these units prove ideal for such service. To obtain best economy at part loads, the steam turbine should be designed with auxiliary nozzles that can be cut in or out with changes in turbine load. In most cases rate of pumping changes gradually and steam flow to the turbine nozzles can be controlled by auxiliary valves, manually opened and closed by the operators to suit the load. Where variations in pumpage may be sudden, or where local conditions may make it advantageous, the more expensive automatic nozzle control may be warranted.

Except for the need of speed adjustment and economical operation at part loads, no special requirements are imposed on steam-turbine design. Therefore the turbine can be of a suitable size for the load, with conventional governors as for any mechanical drive. Some installations make provision to bleed low-pressure steam from the turbine to heat feedwater or for other uses. Generally the amount of low-pressure steam needed is small, requiring no changes in basic design of turbine.

Except for units of small capacity, reduction gears must be provided between the steam turbine and the pump. Some early installations of turbo-centrifugal pumping units were objectionable because of noisy gears, but modern gears operate quietly.

Pumping Heads

While a few turbo-centrifugal units are used for low-head service, pumping raw water to treatment plants, most installations are for distribution. The pumping heads usually permit the use of single-stage double-suction pumps, but there are a number of higher-head installations where series pumping units have been used.

In designing the various items of equipment for these units, the manufacturer must consider a number of factors and variables so that all parts will function as a unit. The wide varia-

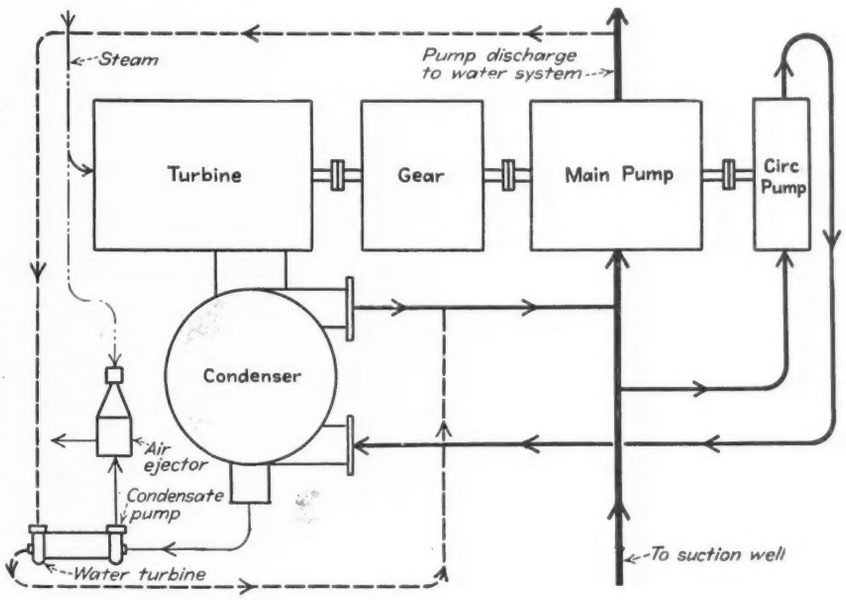


Fig. 3—Flow-diagram of a steam-turbine-driven centrifugal pumping unit equipped with a 2-pass power-plant condenser and a circulating water pump driven from the main pump shaft and taking water from the main pump suction line

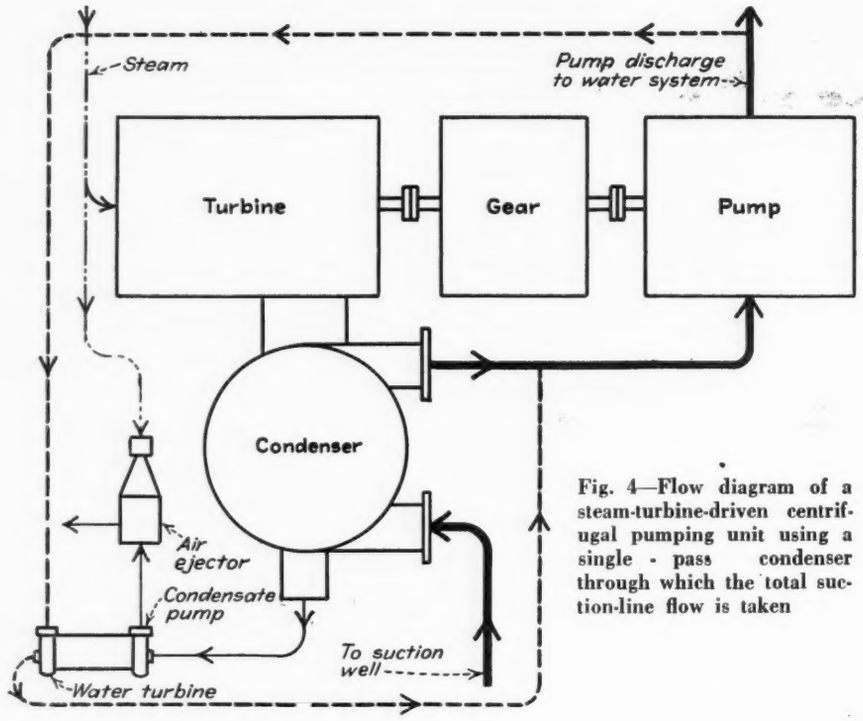


Fig. 4—Flow diagram of a steam-turbine-driven centrifugal pumping unit using a single - pass condenser through which the total suction-line flow is taken

tion in water temperature causes correspondingly wide variation in the vacuum produced by the condenser, thus affecting performance of turbine and condenser auxiliaries. Consideration must be given to the range of operating conditions, as well as to normal requirements, to insure a satisfactory and economical unit. Because of this, the equipment is customarily purchased as a coordinated unit rather than as individual items. These units naturally require interconnecting piping which is usually purchased as part of the unit so that the frictional losses can be properly provided for in the manufacturer's design and thus insure correct operation of the pump.

Meters and Gages

So that operators can properly handle the unit, certain gages and thermometers should be installed. As a minimum, there should be gages for throttle steam pressure, first-stage steam pressure, condenser vacuum, pump discharge, and pump suction pressure; and thermometers for exhaust steam temperature, circulating-water inlet temperature, circulating-water outlet temperature, and condensate temperature. Some form of tachometer, to indicate speed, is absolutely essential. Other gages and recorders are helpful but not essential to good operation of the plant.

Among the interesting features of these units are the variations that are made to suit local conditions. One recent installation had a small direct-current generator directly connected to the pump shaft to supply current for lighting. Another unit, where no basement was feasible, included a top-exhaust turbine with the condenser supported on columns so that the hotwell cleared the floor and gave sufficient submergence for proper operation of the condensate pump.

Combination Units

There are also, in private waterworks plants, combined pumping and electric-generating units using a common turbine to drive both a pump and a generator. Such units can be used only as base-load pumping equipment unless the electric requirements permit variations in the power-system frequency, in which case some variation in pump output can be obtained. In one of these, the unit is located high above extreme low water, and the water is pumped to it by a motor-driven pump acting as a first-stage element with power being supplied from the generating unit.

Putting Units into Service

Putting these units into service can be troublesome if proper provision has not been made in the design. Warming the turbine too long before starting may heat the water in the condenser tubes, through which there is no circulation until the pump starts. This prevents establishing a vacuum and sometimes results in the turbine not developing sufficient power to pump water into the system. Operation of the unit at part speed, with the main pump delivering no water, causes recirculation, by the circulating pump, of a small volume of water through the condenser and is of no help in getting the unit up to operating speed.

Some operators are adept at putting a unit in service quickly before the water in the condenser becomes heated. It is better, however, to provide for a small supply of water (from the mains in most cases) to flow through the condenser during starting. This supply can also be used advantageously to operate the water-turbine-driven condensate pump, if used, and to seal the boxes of the main pump during the priming period. Most installations also have a large-capacity single-stage non-condensing steam ejector, generally called an evacuator, incorporated in the ejector for use during the starting period, to establish the vacuum quickly.

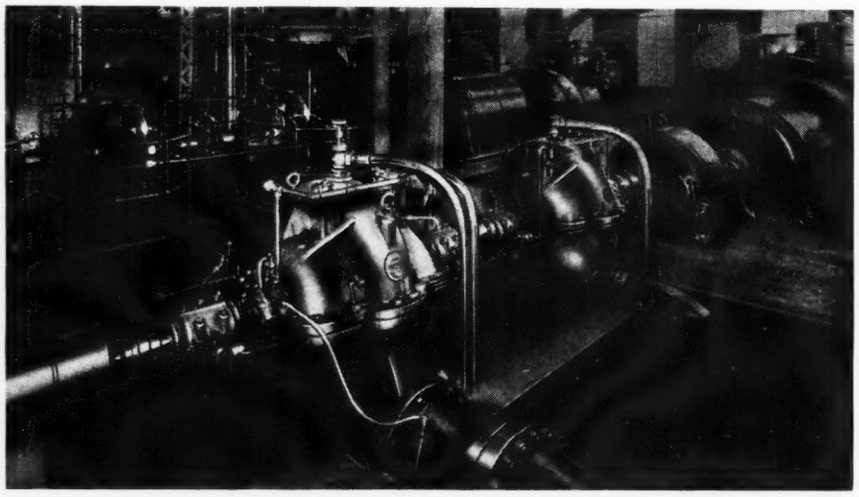
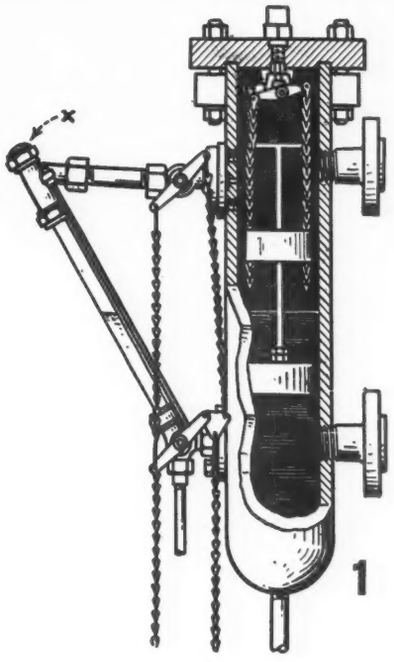


Fig. 5—A 1250-kw alternator direct-connected to a steam turbine and geared to a 13,000,000-gpd pumping unit with dc generator on extreme left to supply excitation current. Power needs usually require such units to operate at constant speed

Five Practical Ways To Measure Liquid Level



Whenever liquids are stored or processed, some method of measuring must be used to prevent waste and to give warning when the supply gets low. Elementary devices, described here, have been gradually expanded and improved to provide neat and accurate instruments, to be described in future articles

► AN INDICATION OF LEVEL is necessary, whenever a liquid is stored or processed in containers, to obtain increased economy, efficiency of operation, closer stock control and to prevent waste and accidents. Perhaps the simplest method of measuring liquid depth is the chain used by sailors to take soundings. Although simple, it is not convenient to use in factory or power-plant tanks which take many shapes and sizes and are located at many different elevations. Other means are required to indicate a true level of the contained liquid. Among these are *staff gages, floats, gage cocks, gage glasses* and *pressure gages.* Controlled compressed-air discharge through a pipe submerged in the liquid also registers liquid level.

A *staff gage,* the least expensive and easiest to make, is commonly used on reservoirs and open tanks. It is nothing more than a piece of channel iron or wood planking with divisions representing quantity or feet of elevation above reservoir bottom. To check the level, the operator must have access to the top of the tank or reservoir. The common measuring stick is a portable staff gage for inserting through small openings in totally enclosed tanks.

Coat The Organic Float

Floats made of wood, cork or other buoyant material can be used to operate many kinds of indicators and transmitters, which in turn relay the information to distant points. Organic-material floats soon lose buoyancy unless given a liquid-proof coating. Boiling in paraffin or beeswax protects against water; shellac will prevent oil absorption. A periodic renewal of this coating extends service life considerably, because once the surface becomes cracked and the float soaked, it cannot be dried satisfactorily unless the entire coating is removed. Troubles from liquid absorption are eliminated with metallic airtight floats and, although slightly higher in first cost, replacement frequency and cost is low. Solid metal weights can be used where one or more are balanced against each other in the same vessel, Fig. 1.

Use Still Well Or Guides

For agitated liquids, the float must have rigid guide rods or be placed within a still well to prevent it from floating around over the liquid surface and giving a false reading. For tanks below floor level, the float is fastened to a rod and target which moves vertically along a staff gage; on overhead tanks a flexible cable moves a target along a staff gage mounted vertically on the outside of the tank.

With only a single pulley, the float moves the target toward the foot of the staff gage as the tank is filled. A triple pulley and counterweight arrangement reverses the target movement so that its position corresponds to the actual liquid level. Self-contained float chambers mounted on the side of a tank at the normal liquid level will indicate within a narrow range when the supply exceeds or falls below a given amount.

Gage cocks, although sometimes used alone, are more often installed as an emergency check against other level indicators such as gage glasses. Two typical designs are shown in Fig. 2. One uses the threaded-stem and the other the lever-operated-pushbutton method of opening. The threaded-stem cock has the advantage of turning action to clean the seat as it closes, while the pushbutton valve must be ground to an accurate seat to prevent leakage. Reseating is also much easier on the threaded-stem valve, as the stem can be refaced in a lathe and does not require final grinding after being replaced.

Gage glasses constitute one leg of a U-tube, the other leg being the tank or vessel itself. Liquid in a U-tube assumes a common level as long as both ends are acted upon by the same temperature and pressure. A higher pressure on one leg will force the liquid down until the height in the opposite leg equals and balances this higher pressure. Temperature difference, as well as a change in specific gravity from steam bubbles, of the liquid in the two legs will also cause an unbalance in the levels. This accounts for a slightly higher water elevation in a boiler drum than that shown by the gage glass some distance away.

Correct Venting

Gage glasses are more commonly used for inside storage tanks and boilers if level indications need not be transmitted. They can have both ends connected, Fig. 1, or as in the bearing-oil-level indicator, Fig. 3, with only one end connected. When only the single connection is used and the main vessel is vented to atmosphere the free end also must be vented, or a false reading will result. Motor bearing-oil-level wells having their upper end closed by a hinged metal flap depend on the uneven contact of the metal cap for venting. If the cover is flapped closed continually, it will hammer the metal to an airtight seal against atmospheric pressure. The oil will then rise and seep out under the cover; this trouble can be corrected by drilling a vent hole in the cap or by filing a notch in the top edge of the well.

Circular glasses must withstand the pressure acting on the cross-sectional area at the end of the glass as well as the internal pressure. A short glass is

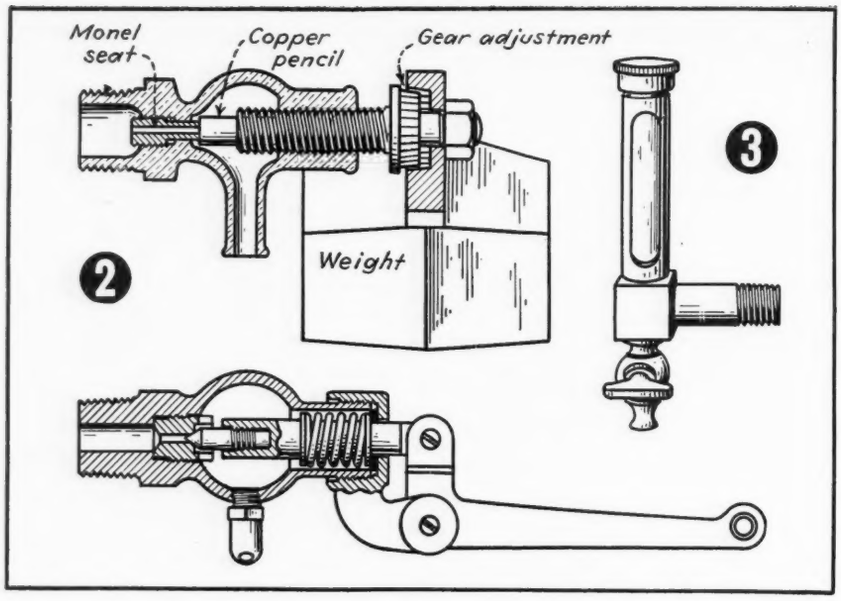


Table I
Recommended Maximum Working Pressures for Tubular Gage Glasses, psi

Length, in.	Corning std.	Pyrex broad red line, red line and h-p	Pyrex heavy wall
Up to 10	200	500	600
11 to 20	200	420	600
21 to 30	200	340	600
31 to 40	180	290	...
41 to 50	160	220	...
51 to 60	130	180	...
61 to 70	100	140	...

quite stiff and not appreciably bent by a load of this size, and its resistance to internal pressure is practically unaffected. A long tube, however, tends to bow or bend, causing a stress in the tube wall and adding to the stress caused by internal pressure. The longer tube must be used on a lower pressure than a short one if there is to be the same total stress in the wall.

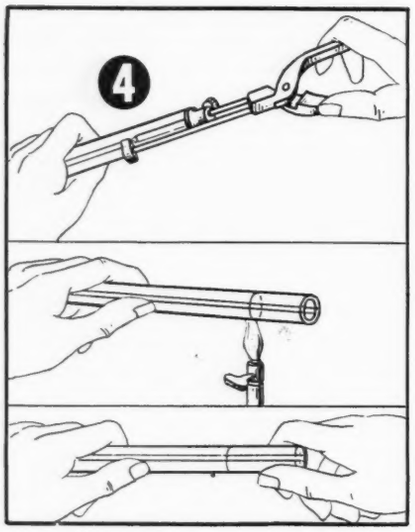
Although there are no hard and fast rules covering gage glasses for different pressures, recommended practice has placed certain limitations on the kind and length of glass, see Table I. This is supplemented by a recommendation that flat glass be used on power boilers for all pressures up to 350 psi and flat glass with mica inserts or mica alone for the higher pressures.

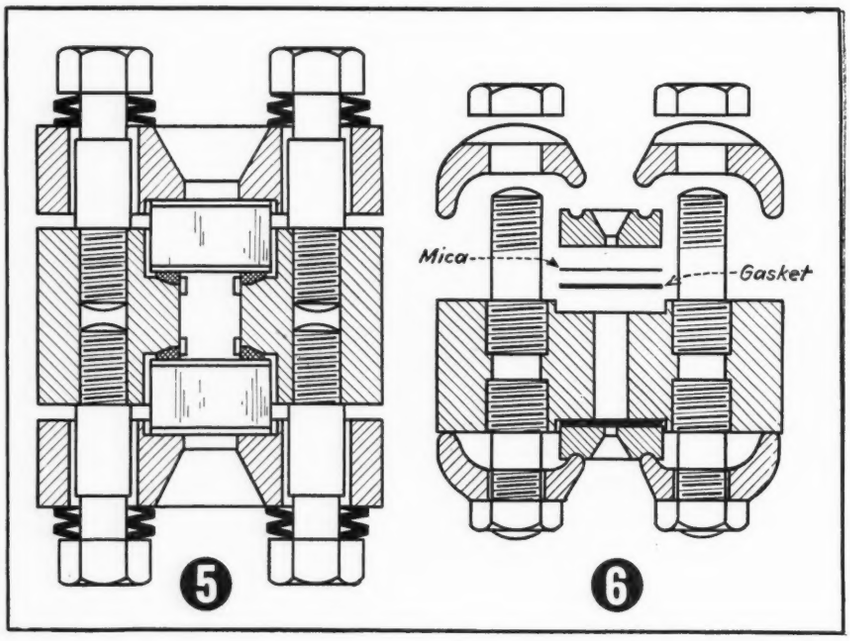
Circular glasses should be of the best material available and bought already cut to the correct length, as the manufacturer is equipped to produce a good fused end. Most operators prefer the inside cutter, Fig. 4, to cut circular glass, because it prevents flaking the inside edge. After being cut, the glass ends should be fused to a smooth surface. Always allow a length sufficient to reach past the upper packing recess with the glass resting on its seat in the bottom gage fitting. If you let the glass extend too far into the upper fitting, you give greater opportunity for etching to take place. Any extensive sign of etching is a warning that the glass should be replaced. Metal objects will nick the glass and should not be used for cleaning purposes.

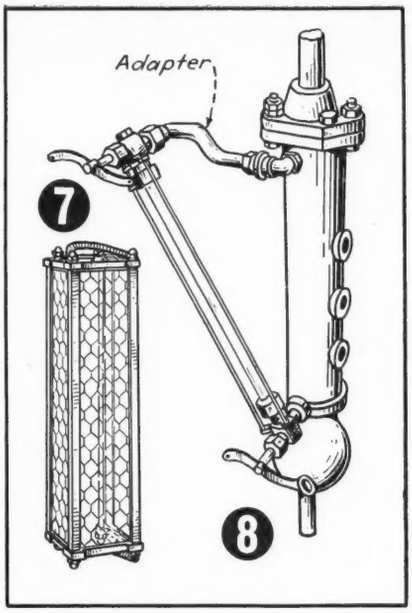
When provided, the cap or plug *X*, Fig. 1, should be removed from the upper fitting and the glass inserted at this point. Don't turn the fitting from its normal position, insert one end of the glass, and then turn the fitting back so that the lower end can be inserted in the lower fitting. Glasses should be of the correct diameter to slip easily into the gland—if they are too tight expansion against the metal parts will break the glass.

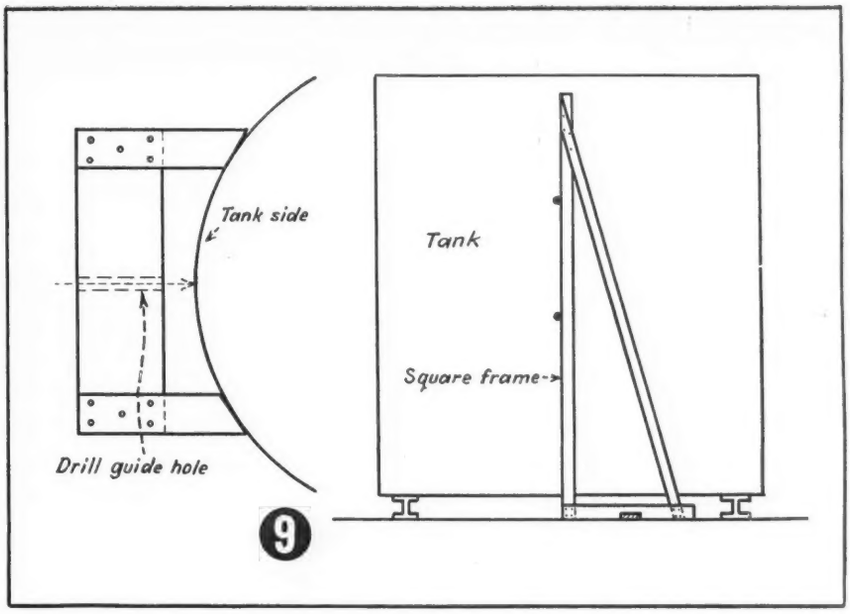
After the glass is in place, push the packing and packing follower or washer into position. The packing should fit easily into the gland without being forced with a hammer or other

Fig. 4—Score the inner surface, heat uniformly until the glass cracks, then break by hand. Fuse the end smooth









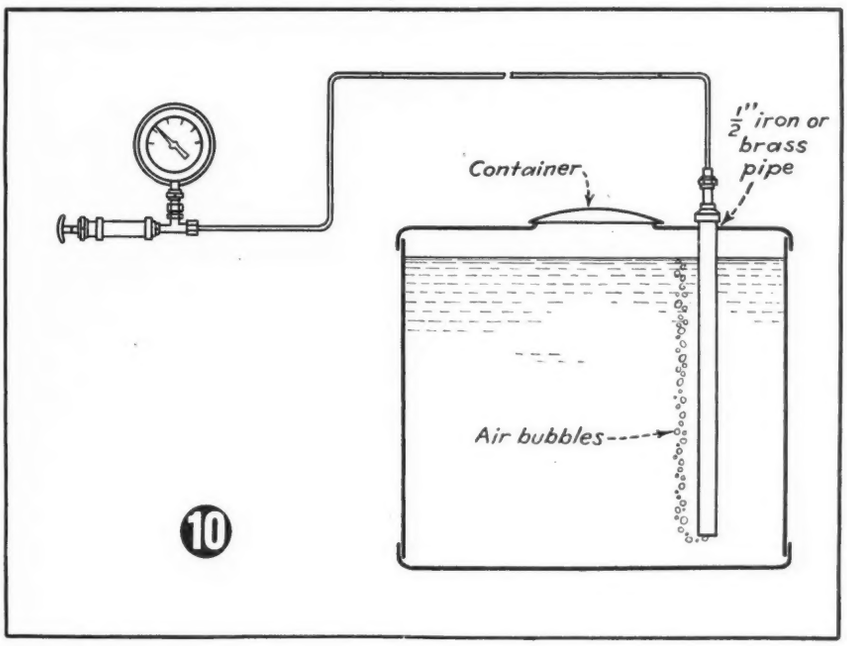
tool. Don't use a wrench to turn down the gland nut; thumb-tight is sufficient and allows for normal expansion which can be tested by turning the glass by hand. If a wrench is needed to stop leakage, insert new packing instead of applying extra pressure to the old. A slight initial leak will cease when full operating temperature is reached.

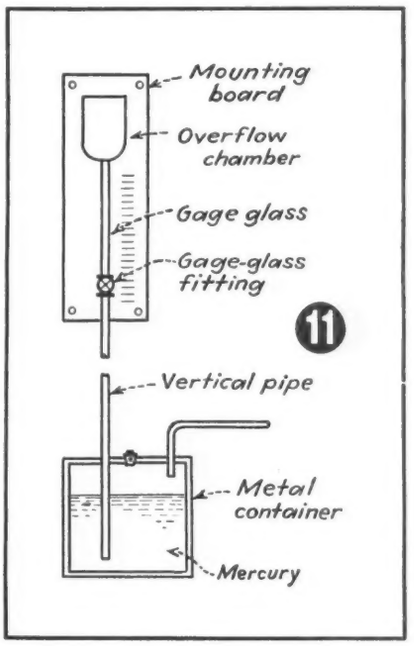
Poor-quality washers lose their resiliency very quickly and soon permit steam to escape; this rapidly increases until the entire washer blows out or sufficient steam escapes to set up violent vibration and unequal expansion. Gage-glass washers for low and medium pressures are made from a high-grade vulcanized composition; for higher temperatures and pressures, asbestos or metallic packing is necessary. Asbestos is not recommended for circular glasses as it grips the glass too tightly and prevents longitudinal expansion.

The flat gage glass is available in two designs—one with clear and the other with reflex glass. The clear or plain glasses, Fig. 5, are installed to form two sides of a case containing the column of water. With proper illumination behind the glass the water level is plainly visible. Reflex glasses have longitudinal ridges on the back surfaces which act as prisms to reflect the light above the water level, giving that portion of the glass a bright silvery appearance which contrasts sharply with the black part below the water level, making accurate reading easy.

Mica inserts are used with flat glass as they offer high resistance to etching and lengthen the glass life considerably. When used alone, Fig. 6, a mica thickness of 0.025 in. is suitable for pressures up to 450 psi; for higher pressures it should be not less than 0.035 in. thick. Discolored mica should be resplit and the good sheets saved for building up other inserts, because this material is now on the restricted list.

Flat glasses, which have a large area clamped by metal parts, need metal frames supporting the glass uniformly around the rim. Uniform tension is assured by spring washers in the design of Fig. 5. When installing a new glass draw the clamping nuts up thumb-tight and then tighten in pairs to give a





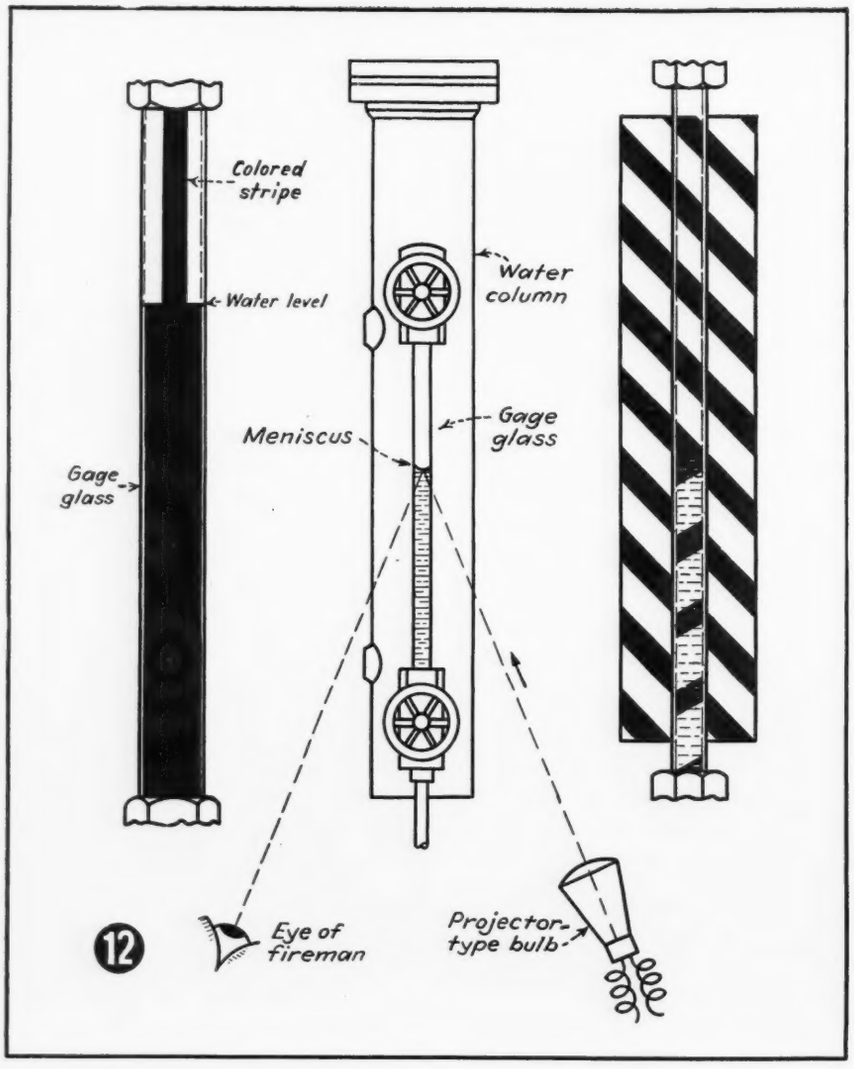


Fig. 12—Use one of these methods to bring out the level with greater clearness

uniform clamping sufficient to effect a positive seal against leakage.

A gage-glass protector made from wire-embedded polished plate glass is available which prevents broken bits of flying glass, hot water and steam from injuring operators. This consists of a metal frame supporting the 4-sided glass inclosure, Fig. 7, suitable for mounting around the circular gage glass. The plate glass, which will not shatter or fly, is designed to withstand the shock of bursting gage glass.

For high overhead gage glasses, an adapter, Fig. 8, can be used to transform a vertical glass into an inclined gage. This permits easy level reading from the operating floor. Adequate lighting of the gage glass also helps visibility. A painted plate with stripes, similar to a barber pole, placed behind the gage glass increases visibility; directing the beam from a spotlight, mounted at an angle below the glass, will also make the water level stand out with greater clearness, Fig. 12. Another method is to place a vertical stripe on the back of the round glass.

When installing gage-glass fittings on a circular surface, use extreme care to insure that the fittings are in proper alignment and that no strain will be placed on the glass itself. To drill curved surfaces, hold the drill level and point it at the center of the tank. A template and drill guide or floor square, Fig. 9, can be used on any tank to hold the drill in correct position. If you use the floor square, make allowances for any out-of-level condition between the tank and the floor.

After the hole positions are marked, move the square out a drill's length away from the tank, keeping its edge in direct line with the hole mark, then move to the right a distance equal to half the drill diameter. When drilling keep the drill level, with its side just touching the square edge. Tap the holes accurately so that the gage fittings will protrude the same distance and be in perfect alignment with each other. Tipping the fitting to the right, left, up or down, will bring the glass in contact with metal parts of the fittings and cause breakage within a short time.

Pressure gages are suitable for liquid-level indications when they are fitted with the correct scale. When adjusted to take care of pressure drop, a gage can be installed on the pipeline at some distance from the tank. The operating element, consisting of a bourdon tube, metallic bellows, flexible diaphragm or mercury chamber, can be actuated by the liquid pressure or by air pressure sufficient to balance the liquid head. Fig. 10 shows a simple liquid-level indicator consisting of a low-reading pressure gage, hand-operated air pump and necessary piping. Gage dial can be calibrated in quantity or feet corresponding to tank height. The pump fills the pipe with air of sufficient pressure to overcome liquid pressure and excess air leaks out at the lower end of submerged pipe. Pressure acting on the gage is equal and corresponds to the pressure from the liquid surrounding the pipe.

Indicator For High Levels

In the mercury-chamber indicator, Fig. 11, the liquid head is converted to mercury head and provides accurate indications for high overhead tanks. Although mercury cost is high, the device itself can be constructed and installed at small cost. With a specific gravity of 13.58, 0.88 in. of mercury is equivalent to one foot of water and a short mercury gage will serve a storage tank of considerable height.

The liquid-level indicators as described above are simple, easy to construct or install, and will give adequate service except where operating conditions require more accurate measurement or transmission to a central control point for checking process work.

For information in preparing this article POWER is indebted to the Cochrane Corp, Philadelphia, Pa.; Bristol Co, Waterbury, Conn.; Crosby Steam Gage & Valve Co, New York, N. Y.; Foxboro Co, Foxboro, Mass.; Leeds & Northrup Co, Philadelphia, Pa.; Mason-Neilan Regulator Co, Boston, Mass.; Republic Flow Meters Co, Chicago, Ill.; C J Tagliabue Mfg Co, Brooklyn, N. Y.; Yarnall-Waring Co, Philadelphia, Pa.; Reliance Gauge Column Co, Cleveland, Ohio; The Paul B Huyette Co, Inc, New York, N. Y.; Lunkenheimer Co, Cincinnati, Ohio; J E Lonergan Co, Philadelphia, Pa.; Brown Instrument Co, Philadelphia, Pa.; Corning Glass Works, Corning, N. Y.; and Ernst Water Column & Gage Co, Livingston, N. J.

Engineers Wanted—For Fast Geared-Turbine Cargo Ships

Official Maritime Commission Photo

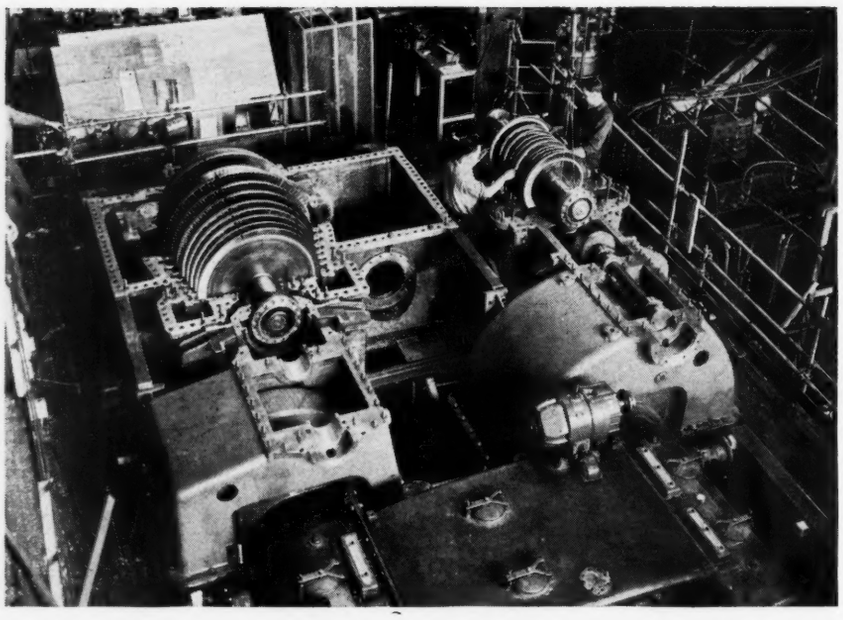
Speedy queens of the merchant fleet are the Maritime Commission's C-3 geared-turbine cargo ships. Propulsion machinery equalling that of best land installations will require many qualified operators for engineer-officer berths. Register now with the War Shipping Administration

▶ To an engineer who has once worn stripes the modern geared turbines and watertube boilers of Maritime Commission C-3 cargo ships represent the finest machinery afloat. To an engineer whose experience has been gained in stationary plants, propulsion equipment of these vessels will look much like new equipment in his own plant. The War Shipping Administration encourages both these classes of men to ship below decks to utilize their specialized skill for maximum benefit to the war effort.

If shipbuilders had unlimited supplies of all types of machinery, most of our rapidly expanding merchant fleet would be powered by geared turbines. Only because gear and turbine shops are filled with orders for vital warship equipment are the Liberty ships being powered by reciprocating engines. However, more than 50 geared-turbine ships are already on or off the ways. Also building are geared-diesel, direct-drive diesel and turbine-electric vessels.

Where turbines are the prime movers of ship propulsion, some form of speed reducer must transmit power from the inherent high speed of turbine rotors to the necessary low speed of an efficient propeller. Reliability and simplicity in operation are primary requisites and these are well filled by herringbone gears. Once a set of gears has been built according to modern standards of close tolerance, only adequate lubrication is required to assure many years of operating life. However, it takes many days of 24-hr cutting to finish a single large gear on special hobbers of which American manufacturers have all too few. These hobbers must also produce battleship, cruiser and destroyer gears, all essential to winning a war.

The C-3 ships have a fuel efficiency of about 0.6 lb of fuel oil per shaft hphr as against about 0.4 lb for diesel and 1.2 for reciprocating-steam-engine drive. Two oil-fired watertube boilers supply steam at 450 psi and 750 F. They are equipped with waterwalls and economizers. Mechanical pressure-atomizing burners operate under forced draft up to about 6½ in. water gage, provided by motor-driven fans. Combustion-control systems, soot blowers, and boiler accessories are all much like



Arrangement of turbine and gears can be studied from this shop view taken during assembly for test. Note small size of high-pressure rotor being lowered into its casing and flexible couplings that connect turbines to pinions

corresponding equipment in power plants on land.

Three stages of feedwater heating include a direct-contact deaerating unit and two closed tubular heaters. The lowest closed heater is supplied by bleed from the turbine below atmospheric pressure, the deaerator receives auxiliary exhaust as well as 10-psi bleed and the final closed heater extracts steam from a higher turbine stage. Low-pressure clean-water drains flash to the main condenser.

Motor Drive for Pumps

A typical boiler-feed installation includes a 4½x8-in. triplex pump supplying 160 gpm, driven by a 75-hp motor. Other pumps also are motor driven. Auxiliary power supply comes from two 350-kw 3-wire 120/240-volt dc turbine-generator sets backed up by a small diesel set.

Two vertical circulators supply the 2-pass 7800-sq-ft surface condenser. Standard equipment includes 2-element 2-stage steam-jet air ejectors and motor-driven centrifugal condensate pumps.

Other auxiliary equipment grouped in the machinery space of the turbine room includes a 1500-lb-per-hr evaporator-distiller for fresh water and boiler makeup and a refrigerating compressor-condenser. An air compressor, with receiver, supplies combustion-control apparatus and effects remote operation of certain valves. Two fuel-oil settling tanks have a service pump and a transfer pump with one fuel-oil standby pump in reserve. In addition to usual lube-oil coolers and service pumps, a purifier system, sludge tank and oil heater are provided.

Two auxiliary condensers collect drains as well as dc turbine-generator exhaust. Miscellaneous pumps handle clean ballast, dirty ballast, drinking water, ice water, and makeup feed. Bilge and fire pumps, a sanitary pressure set and other standby pumps complete the liquid-moving apparatus. Even a domestic hot-water heater is included for galley service and showers.

Main turbines are built by any of several manufacturers according to their own detailed standards, but all single-screw ships have about the same power-output rating from a cross-compound unit driving the main shaft through double-reduction gears. The high-pressure rotor turns about 5000 rpm while the low-pressure element is designed for about 3500 rpm. Each drives a separate pinion and gear through flexible couplings; the power output combines only as the intermediate pinions mesh with the bull gear.

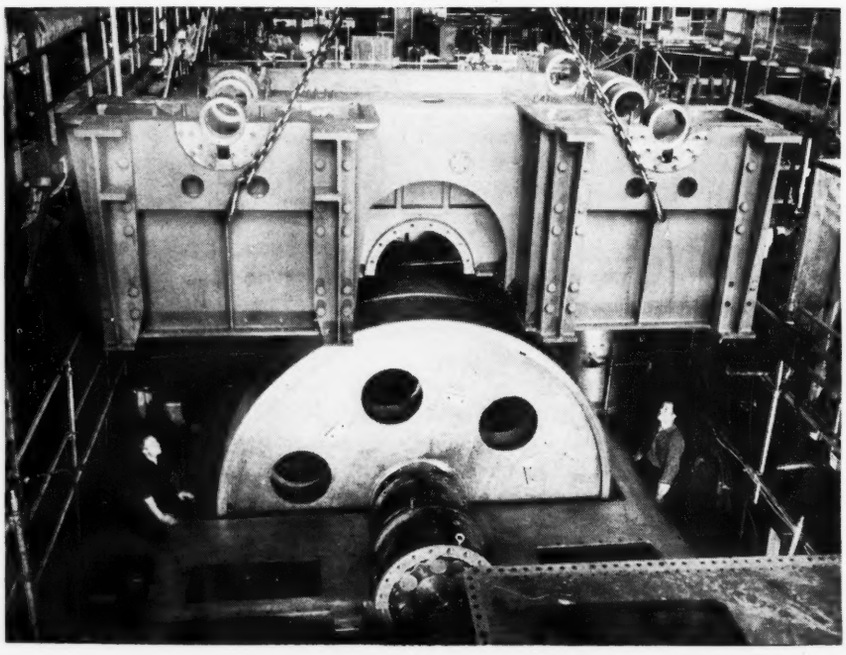
The 3-stage astern wheels, located at the head end of the low-pressure element, can deliver 40% of ahead power with 80% of ahead full-load torque at about 60% propeller speed with normal ahead full-load steam flow. A slow-speed motor-driven turning gear is provided. The segmental thrust bearing is located just forward of the main low-speed gear.

Engineer Shortage

Most of the propulsion equipment, as will be seen from the foregoing description is of the same type and kind as would be found in an up-to-date stationary power plant. Except for gears and deck auxiliaries, operating and maintenance problems do not change greatly with the transfer of equipment to shipboard. For this reason, the War Shipping Administration invites stationary engineers with oil-fired boiler and steam-turbine experience to inquire into the advantages now offered qualified men who go to sea with the merchant marine. Many holders of marine licenses are now receiving a letter request suggesting such registration.

The War Shipping Administration aims at (1) drawing back to engineer-officer berths men with saltwater or Great Lakes experience now working at shore jobs (2) preparing shore-experienced engineers in the shortest possible time for merchant-ship officer berths (3) arranging training for enough new marine engineers to fill the balance of the personnel needs. Dis-

Intermediate section of a welded gear casing being lowered for shop test. The three main sections are annealed after welding, then bearing seats are bored by the same machine from the same end to assure perfect shaft alignment



trict offices at New York, San Francisco, and New Orleans, supplemented by port offices at Boston, Philadelphia, Baltimore, Norfolk, Savannah, Jacksonville, Tampa, Mobile, Galveston, Los Angeles and Seattle, are now registering and recruiting personnel.

Operator Requirements

Applicants fall into two groups (1) those who hold or who have held marine engineers licenses and (2) engineers with reciprocating-engine, turbine, turbine-electric and diesel experience who have never been to sea. To all intents and purposes there are no age limits or stringent physical requirements. As to the latter, it is required only that a man be able to do such physical work as his position requires and get about ship in safety.

Operators who have no marine papers are shipped as deck engineers or pumpmen for a required 3-month period after which they become eligible for third-assistant engineer by taking a license examination. Typical examination questions can be had by writing the Bureau of Marine Inspection and Navigation in Washington. A third-assistant engineer must know the answers to such items as (1) the difference between dry-vacuum and wet-vacuum systems (2) the functions of dummy pistons in reaction turbines (3) the arrangement of single-reduction and double-reduction gears (4) simple indicated horsepower and air compressor calculations (5) elements of refrigeration systems, electricity and pumping.

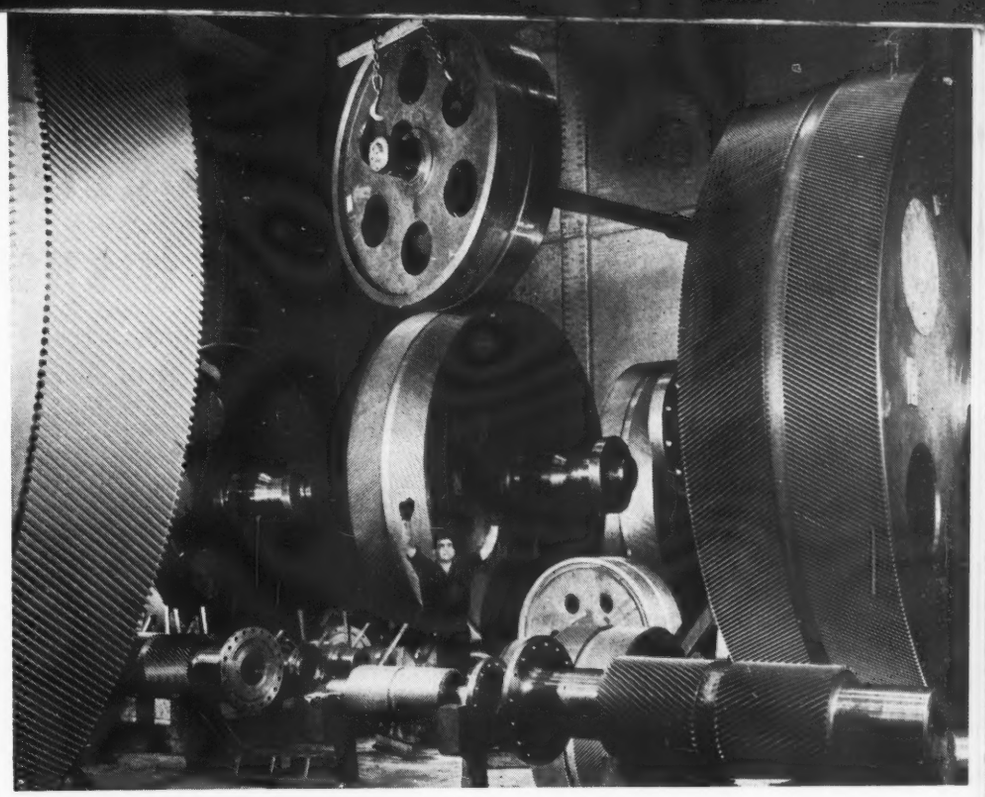
Every engineer is given opportunity to join one of the maritime unions if he so desires but membership is not compulsory under present acute manpower shortages. Arrangements are in prospect for certain refresher courses in marine engineering as the need for such instruction develops.

Of all offered incentives, the most important is the opportunity for any power man to take a direct and active part in the war effort where his services will carry the most weight. In addition, relatively high compensation rewards the natural rapid advancement that necessarily occurs in expanding the merchant fleet. Deck engineers and pumpmen start with about $100 per month base pay with 15% additional temporary compensation plus bonuses amounting to 100% or more of base pay. Advancement to third-assistant engineer is accompanied by a 60% increase above these levels. A C-3 chief engineer can expect more than $800 per month of sea duty.

In addition to direct compensation, every crewman and officer is protected by $5000 of insurance for which he pays nothing. If a greater amount is necessary to care for the normally larger families of older men, several private companies write policies especially for merchant mariners at an extra cost of $50 per year per $1000 of insurance above the normal rate for the applicant's age. Existing insurance is not voided by change of occupation to marine engineer.

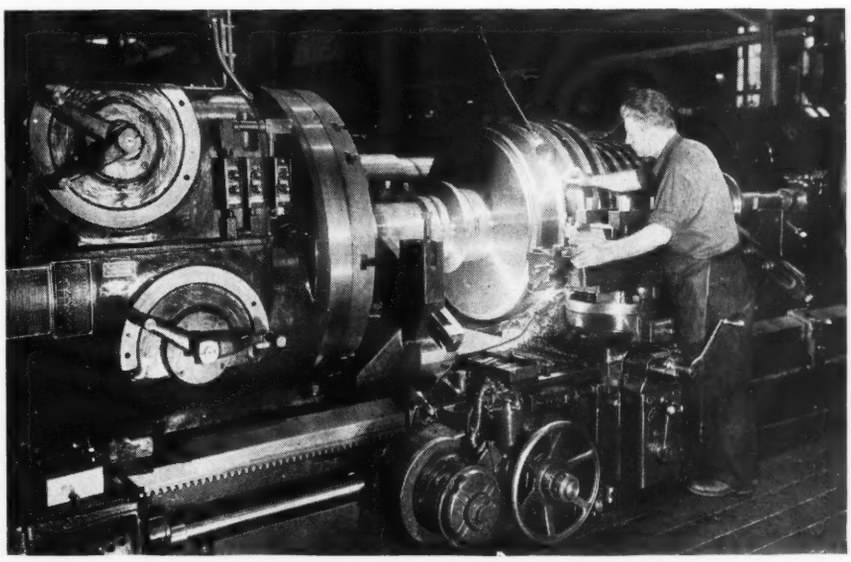
Volunteer Basis

No attempt is being made to recruit marine engineers on other than a voluntary basis simply because none has so far been necessary. Engineers have responded to the call of the sea and to the wartime needs of their country. Those who have already shipped are boosters and return again and again. There is every prospect that personnel recruitment will keep up with new launchings as shore engineers become more fully informed of the incentives offered in the merchant marine aboard good ships for a permanent career.



Precision methods form teeth to within 0.0003 in. at all points of even a 200-in. "bull" gear. Finish cuts are made in air-conditioned rooms without interruption of the machining operation; stopping the hobber would spoil the gear

Shop photos by General Electric Co



Turbine manufacture involves all the special skills of metal working—casting, forging, machining and welding. Here a workman measures blade dovetail cut

Radium—Modern Tool For Boiler Inspection

Like X-rays, radium may be used to reveal hidden defects in boiler metal. Here's a brief outline of principles and methods

By HARRY SPRING

▶ WHILE THE DETAILS may be left to specialists, every power engineer should understand how radium can be used to photograph hidden defects in boiler metal. Before discussing this practical problem a few words about radium and its discoverers should be of interest.

In 1896 Henri Becquerel, a French physicist, left some uranium in a drawer with an unexposed photographic plate. The uranium made a shadow picture on the plate. Later it was found that the rays did not come from the uranium itself, but from an impurity. This led to further search for the real source of the radiation in pitchblende (uranium ore). Starting work on this in 1898, Madame Curie extracted a decigram of pure radium in 1902.

Radium gives off radiations that penetrate solid matter and affect photographic films. It also gives off a gas (radon) which is radioactive, but which soon destroys itself.

For many years the practical applications of radium were almost entirely in the field of medicine. Meanwhile experimenters discovered the alpha, beta and gamma rays of radium. It is the gamma rays that are of particular interest to mechanical engineers. Similar in type to high-frequency X-rays, they have the enormous penetrating power needed to traverse commercial thicknesses of steel plate.

It was only about fifteen years ago that radium was first put to practical use to reveal the internal structure of steel plates. The gamma rays of radium act much like X-rays. Both will pass through steel and create shadow pictures on a photographic film on the other side of the steel. When the film is developed it comes out black where exposed directly to the rays that did not traverse metal, white where protected by very great thicknesses of metal, and gray of various tones for lesser thickness of metal.

Defects Show Dark

With proper exposure, a uniform steel plate might show on the film as a uniform light gray. If the effective thickness of this plate is reduced at any point (say by machining or by voids in a weld) the mass of metal traversed by the rays is correspondingly reduced at that point, producing a dark spot on the shadow negative.

The choice between gamma ray (radium) and X-ray inspection is a matter of individual economics with the factors different in each case. With machines of suitable size, the X-ray may be far more rapid than the gamma ray. On the other hand, radium may be used in locations where an X-ray machine would be impracticable. A radium container for 100 to 300 mg looks like an undersized pear (Fig 1) whereas a portable X-ray machine to serve the same purpose occupies considerable space and may require an automobile trailer for transportation.

The comparative cost of radiographic investigation by X-ray or radium is generally the primary factor in determining which method to employ. Other

Fig 1—Duralumin container for 100 to 300 milligrams of radium salts

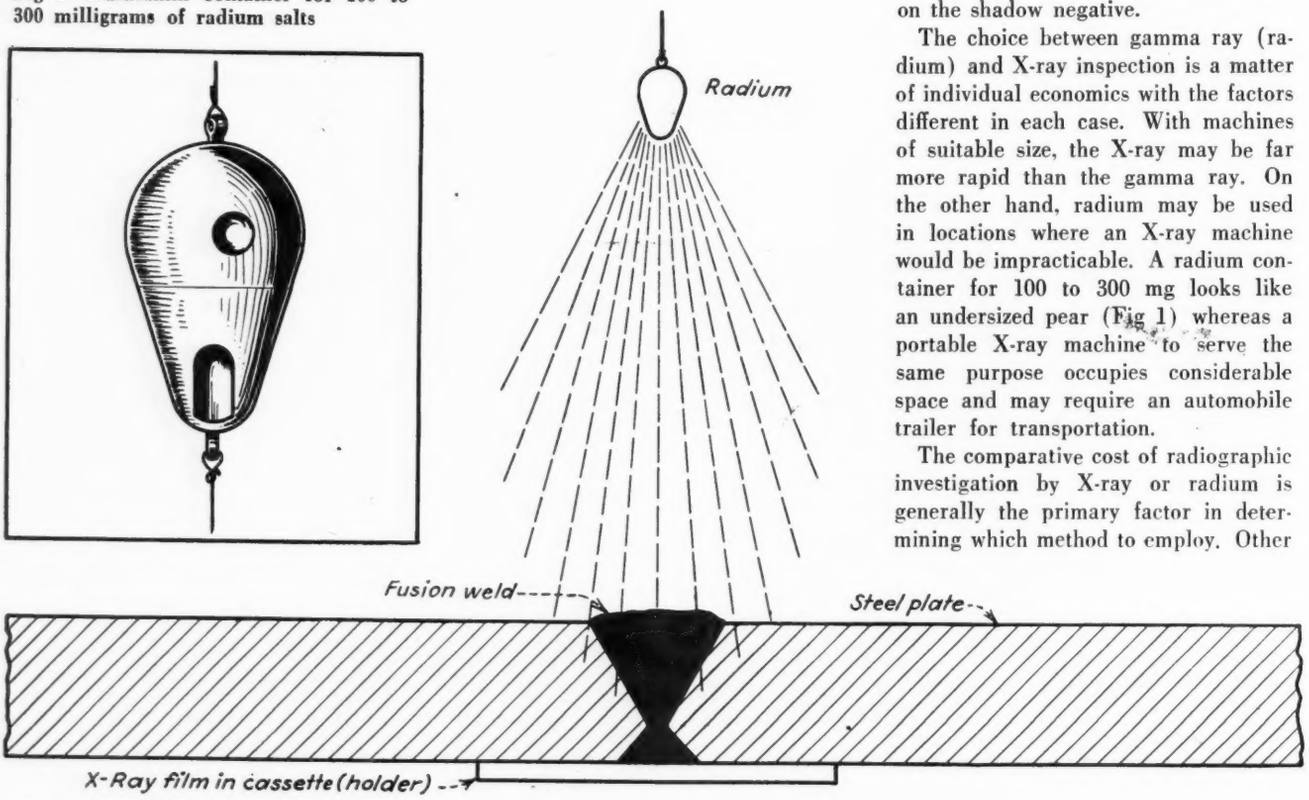


Fig 2—With radium, as with the X-ray, the resulting "photograph" is nothing but a shadow picture. The greater the thickness of metal traversed, the lighter (in tone) is the corresponding part of the film. Remember that "shadows" show white on photo film

important factors include the time to make the set-up and the exposure.

Rental of suitable X-ray machine for a month might run into a cost of over a thousand dollars. On the other hand, if a large number of exposures through a thick-walled vessel were to be considered, the much greater time necessary for gammagraph (radium) exposures, might make radium impractical. Before arriving at this decision, however, one should weigh also the time necessary to set up the X-ray equipment against the easy portability of the radium capsule.

With a certain distance from the source of radiation to the photographic plate, and with a steel thickness of perhaps 3 in., the actual X-ray exposure (with a very large modern machine) might be made in the matter of a minute or so for each picture, once the set-up was complete. Under the same conditions gamma-ray pictures might take as long as 12 hours, or even more, per exposure.

The capsule shown in Fig 1 is a hollow, two-piece duralumin cartridge with a threaded joint in the middle. The radium salts (radium and barium) are in a thin-walled silver container placed inside the duralumin capsule.

Radium is Dangerous

Improperly handled, the capsule can be very dangerous to personnel. It should be handled only with tongs and by experienced persons. The U. S. Department of Commerce bulletin on Radium Protection specifies 3 ft as the minimum safe distance at which one may be exposed to 100 mg of radium for a maximum time of one hour in a day. When the radium is stored behind a lead wall 3 in. thick, one may be exposed for eight hours a day, not closer than 14 in., without danger.

Uses of radiography include investigations of welded seams, castings and other steel structures for internal cracks, voids or similar defects.

The ASME Code for Power Boilers requires radiographic examinations of all strength welds in boiler shells or drums. The Code for Unfired Pressure Vessels also requires radiographic examination of welded seams in certain classes of unfired pressure vessels. For this the manufacturer most commonly uses X-ray equipment.

Field Inspections

However, radiographic examination is not confined to the shop or new construction, nor to the X-ray. Field examination by radium may be used to reveal suspected hidden defects in existing boilers, piping or machinery.

An X-ray film is placed on one side of the object being investigated, while radium radiations are created on the other side. Fig. 2 shows a typical setup for gamma-raying a welded seam in a steel plate.

One typical experience involved a welded seam in an 8-in. steam line from a high-pressure boiler. On the outside the weld looked good enough, except in one spot where a fine crack was noticed for about one-eighth of the circumference. Because of this the entire joint was condemned.

To show what gamma-raying would reveal, the section containing this weld was cut off and wrapped with X-ray film. Three cassettes (film holders) were used to extend around the circumference. The radium capsule was placed in the center line with the weld. The gammagraphs showed clearly that while the crack was visible only on part of the surface, the defect extended under the surface for almost the entire circumference.

To compare the gammagraphs with the internal structure of the weld the pipe was sectioned and a strip cut across the weld at locations centered to each of the gammagraphs. The investigations revealed that the cracks can develop as a result of a poorly designed joint. The edges of the pipe had not been veed and no backing ring had been used. The globules of metal "icicles" at the root of the weld were clearly visible in the gammagraphs. A backing ring during welding would have prevented this (see Fig. 3).

One might readily ask how a gammagraph could be obtained if the welded joint were, say, several feet from the pipe joint. Shift the pipe enough so that a thin guide tube may be inserted and centered. Then wrap X-ray film around the weld. The radium capsule is drawn in by its leader string until it strikes the drilled, blind end of the guide tube. Fig. 4 shows typical setup.

(Although Mr Spring made available the various gammagraphs mentioned in this article they are not reproduced here because differences in density sufficient to show defects on the film would be lost in halftone reproduction—Editor)

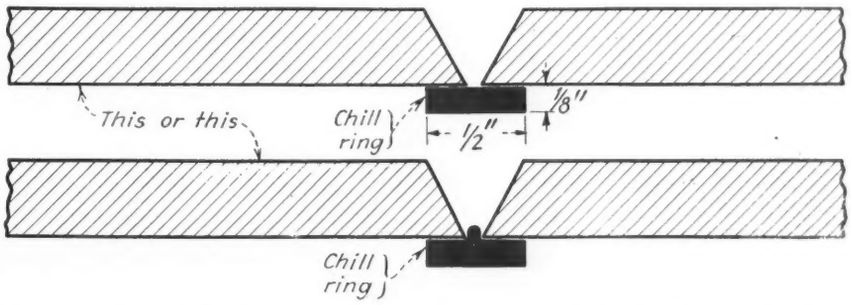


Fig 3—For best quality butt weld in pipe, vee at correct angle, slightly separate pieces and weld down to a backing or chill ring to insure penetration yet avoid "icicles"

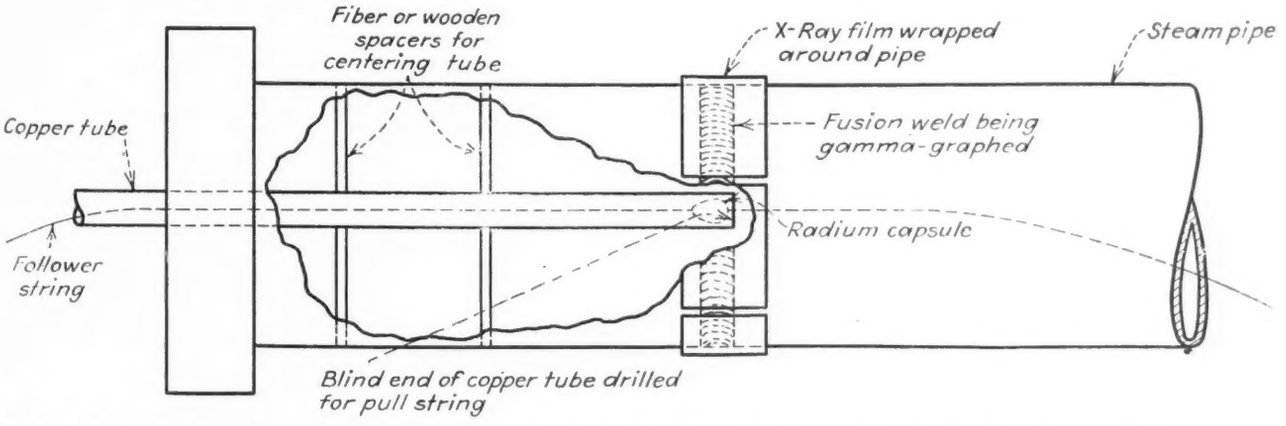

Fiber or wooden spacers for centering tube
X-Ray film wrapped around pipe
Steam pipe
Copper tube
Fusion weld being gamma-graphed
Radium capsule
Follower string
Blind end of copper tube drilled for pull string

Fig 4—To radiograph a pipe weld, radium capsule is positioned inside weld in a centrally supported thin copper tube

Practical Pointers

Short rigid pipelines are difficult to install and maintain unless some simple fundamental rules are obeyed. Arthur H Korn dis-

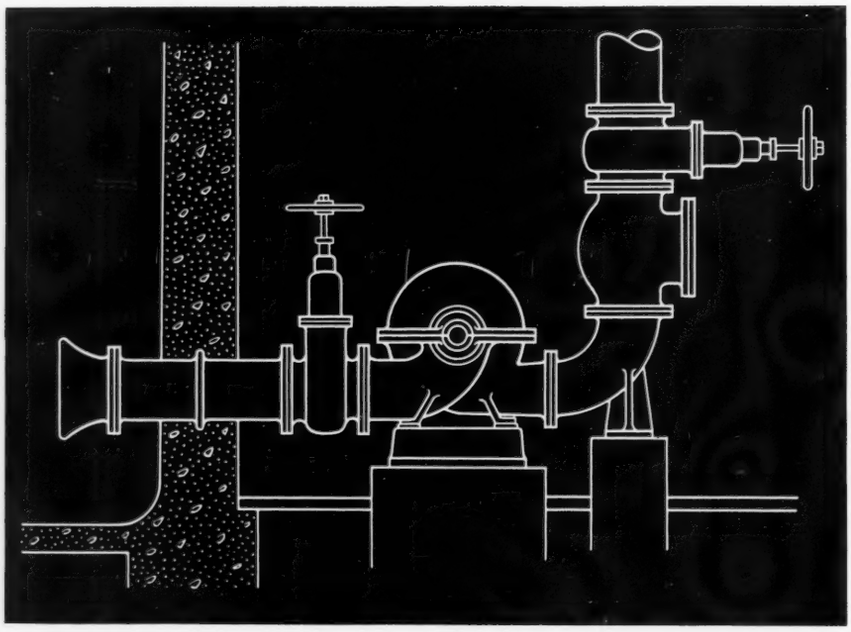


Fig. 1—Although space-saving, this hookup does not allow for bolt-hole alignment

▶ WHEN A PIPE FITTER puts a half dozen bends in a pipeline that seemingly could be done with a single straight run of pipe the young engineer may think he is wasting material as well as time. There are generally a number of good and sufficient reasons for this practice, as a study of piping troubles will indicate.

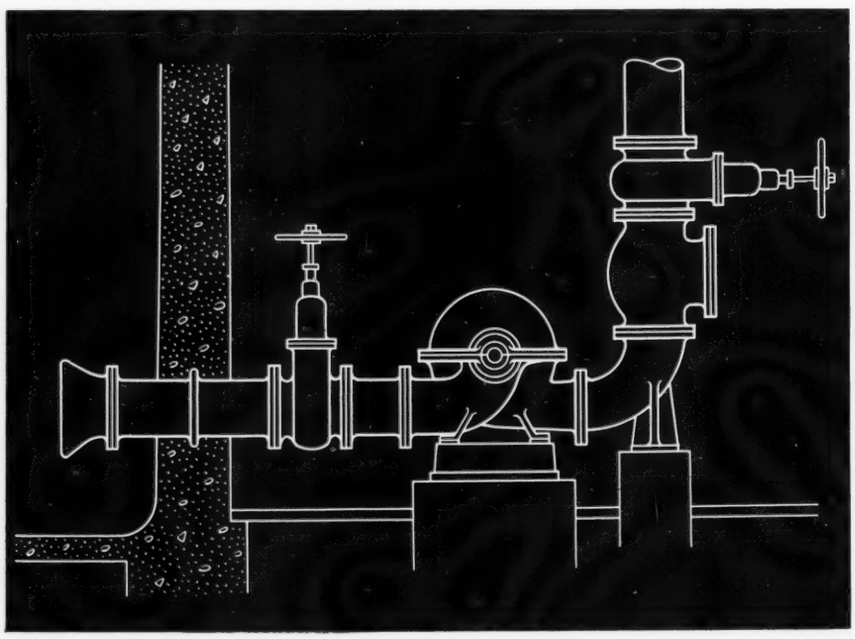
Figs. 1, 2 and 3 show the suction line between a pump and storage tank. To conserve space and reduce friction loss, the pump is placed near the tank. This layout, Fig. 1, consisting entirely of standard parts, is difficult to install when we consider the erection procedure that must be followed. First the tank is built, the concrete being poured with the wall fitting set in the form work. After the concrete has set and the formwork removed, the pump foundation is built. When the pump arrives, or when the building program has advanced far enough, the mechanical equipment can be moved in, and the pump placed on its foundation. Then it is carefully levelled and grouted. After this has been done the pump and wall flanges may not be parallel, or exactly on the same centerline. The distance between the two flanges may not agree with the valve length and the bolt holes in the wall casting may not be in line with those of the valve flange after it has been bolted to the pump suction connection.

These troubles can be overcome by a short piece of pipe between pump and wall casting which must be made up and fitted when the pipeline is being installed, as shown in Fig. 2. This installation introduces difficulties when repairs are made, as it is sometimes almost impossible to remove the valve. After the bolts have been removed the gaskets are found to be adhering tightly to the flanges and no lateral force that could be applied to the valve will free them; even the pump can not be moved on its baseplate because of the grouted-in base elbow.

This problem of gaskets adhering to flanges, and the pipeline not allowing enough longitudinal movement so that flanges can be torn apart by axial force, is found quite often in pipelines. One suggested method is to use an old carpenter's saw on the gasket and literally saw the pipe line apart. This is only possible where flange clearance permits inserting the saw and completing the sawing without binding. It is open to the danger of the possible damage that may be done to the flange surfaces.

Where valve replacement is necessary the new valve length between flange

Fig. 2—Fabricating a short pipe section takes care of bolt-hole alignment



on Pipe Connections

cusses the more difficult cases and gives suggestions which will provide for quick installation and easy removal for repairs

faces may differ by as much as ¼ in., the standard tolerance of the face-to-face dimension on some valves. If the new valve is shorter, the difference can be made up with heavier gaskets; if it is longer, one of the flanges must be machined down. After this has been corrected the problem of getting the gaskets between the flanges without damaging them remains. For these reasons the following simple rule should be observed.

Use an S-bend

On short and relatively stiff pipelines, one pipe length or fitting with unparallel flanges or an S-bend of sufficient offset that can be swung out of line after the bolts have been taken out will eliminate these troubles. This piece must be fitted in the field for length and alignment of bolt holes and flanges.

The alternative of a special S-fitting has been followed in Fig. 3. Sometimes a pump with an inclined flange will simplify the problem. Other remedies include an expansion joint or a Johnson coupling; if space and conditions of operation permit, the pump may be placed at an angle to the wall fitting.

The problem is essentially the same with a steel tank unless it is small and can be moved to suit the pipeline. Although a pump installation is described, another typical case involves the interconnection of storage tanks which include a valve. Fig. 4 shows the plan view of such an interconnection between two circular reinforced concrete tanks. The wrong way to connect them would be by a simple straight pipe on the centerline of the tanks. Two radial and off-centerline inserted wall fittings with an angle elbow as shown in the diagram make a better arrangement. Such interconnections are also ideal for pumps that are connected for parallel operation during peaks, or for standby.

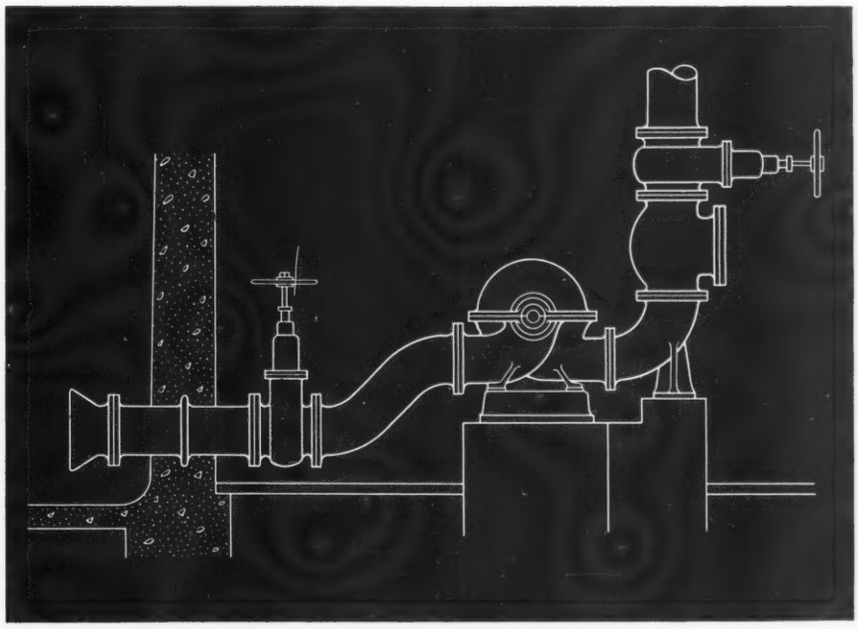
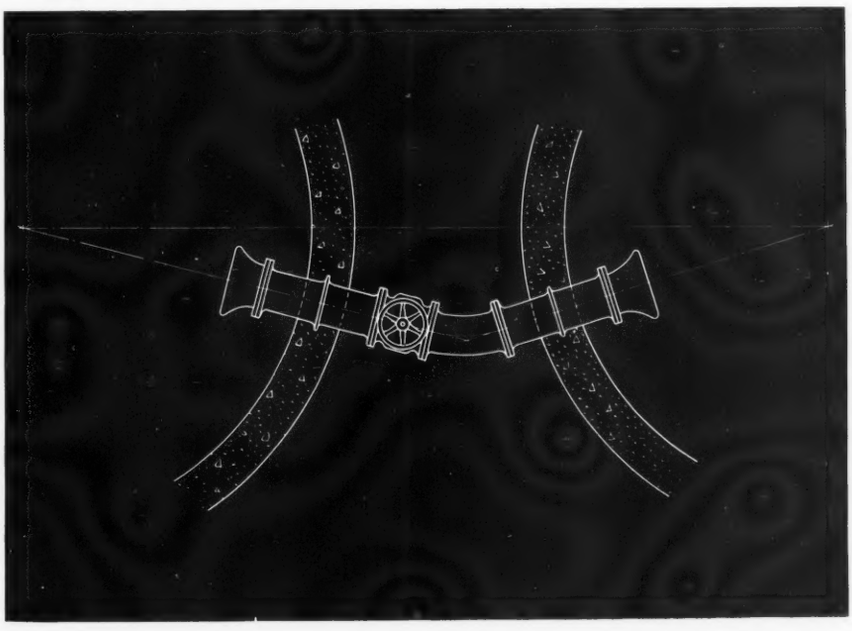


Fig. 3—Gasket insertion or removal is made easy by using an offset section of pipe

Fig. 4—Fittings inserted radially but off centerline permit easy installation



A wall casting in a round tank should always be inserted radially rather than obliquely. The designer can rely on a radial fitting being inserted correctly but he cannot be sure of the same thing being true of a casting inserted at any odd angle. A fitting inserted obliquely causes a circulatory movement of the liquid in the tank, often desirable and sometimes essential, but this can be directed and controlled by a separate elbow or deflector inside the tank.

Many opportunities are presented for designers to prove their skill in conserving space and at the same time providing suitable access to equipment for dismantling and repairs as well as producing a system that is convenient from an operating standpoint.

Silver Improves Lead-Base Babbitts

By H W GILLETT and R W DAYTON
Battelle Memorial Institute, Columbus, Ohio

All engineers know that old-line high-tin babbitts are hard to beat for all-round bearing service. But tin is desperately short and low-tin babbitts must be used. In this article, abstracted from* Metals and Alloys, *the authors report tests proving that silver can pep up certain lead-base babbitts to practical equality with high-tin metal

▶ A TIN SHORTAGE makes it necessary to consider possibilities of replacing tin-base babbitts. These alloys have such a well-rounded set of properties that no substitutes with all of their desirable characteristics have been found.

It is hard to evaluate the "bearing properties" of a bearing metal. Merely to enumerate all the properties that make tin-base babbitts useful is quite a job.

Most of these properties, in approximately the same balance, are found in lead-base babbitts. In service, however, the lead-base babbitts are not considered to be quite as good unless used in an extremely thin layer. Recent automotive practice has proved that when used in a thin enough layer, supported by a stronger backing, lead-base babbitt is the equivalent of a thicker layer of tin-base material.

Shortage of tin thus brings no difficulties where snap-in, backed bearings are applicable. But there are many bearings in which the alignment is not precise enough to allow the use of such thin linings; there are also many old, thick bearings in service that have to be relined from time-to-time with thick babbitt.

Essential Bearing Properties

The properties which led to the selection of tin-base babbitt for these thick linings instead of the cheaper lead base appear to be primarily (1) ease of bonding, and (2) resistance to squeezing out at operating temperature. Many of the substitute materials suggested that would provide the same hot strength as tin-base babbitt are decidedly harder at room temperature and may thus be inferior in embedability.

The best way to obtain a true equivalent for tin-base babbitt appears to be to equal, but not to exceed, its mechanical properties. A babbitt with the same hardness-temperature curve as that of tin-base babbitt, and one that retains its hardness after long aging at operating temperature as tin-base babbitt does might be the objective. Equivalence in bondability and in corrosion resistance is also to be sought.

The ordinary lead-base babbitts approach tin-base babbitts in most properties, but lack elevated-temperature hardness and bondability.

Adding a little silver to lead greatly improves its hardness qualities at high temperature and also changes lead from a very poor bonding material to a solder of recognized value. It therefore seemed logical that silver added to ordinary lead-base babbitt would make it much more nearly the equivalent of tin-base babbitt.

Since the most obvious deficiencies of lead-base babbitt are in hot hardness and bondability, tests of these properties were used for the preliminary weeding out of the experimental alloys. As the work progressed and useful alloys were developed, these tests were supplemented by simulated-service deformation and corrosion tests of full-size bearings.

The work was divided in two parts; first, the selection of the best composition of a lead-base babbitt containing the usual elements; and second, the effect of hitherto unused elements for

For relining bearings such as this when high-tin babbitt is not obtainable, Mr Gillett recommends 15% antimony, 2 tin, 3 silver and ¼ copper, balance lead (see POWER, May, 1942, page 77)

obtaining further improvement.

In the first part it was found that the amount of tin in the alloys was critical, since the alloys were weak if either too much or too little were present, and that copper was a desirable addition, improving both hardness and bondability.

In the second part it was found that silver was an excellent addition, improving the hot hardness, but not causing a corresponding increase in cold hardness or an increase in brittleness. Bondability was decidedly improved.

The alloys tested were melted in a clay-graphite crucible under a cover of fine charcoal, and poured into a steel mold that had been heated to 200 F.

Comparative Data

Alloys were made containing various amounts of antimony, tin and copper, and various additions, including cadmium, arsenic, tellurium and silver, until the optimum range of composition for the new alloys was determined. It was found that aside from those elements commonly used as hardeners, only silver was a really successful addition in all respects. The results of this part of the study are summarized in the table below, which gives data for the best of the many alloys tested.

The bondability data were obtained with 2-in. square sheets of steel that had been pickled and fluxed. Small samples of the alloy to be tested for bondability were placed on top of the steel plates and the plates heated from below with a torch until the babbitt stopped flowing. Babbitts that flowed readily were classed as good; those which did not, as poor.

The first two alloys in Table 1 are tin-base and the next five lead-base babbitts. Comparison with the tin-base babbitts shows that the lead-base babbitts, though equally hard as cast, lose hardness when aged, and at high temperature are not as hard as the tin-base alloys.

Manipulate Composition

These lead-base babbitts can be improved somewhat by manuplating their composition. Alloys with large amounts of tin, like the first three lead-base alloys, are particularly susceptible to loss of hardness by aging and flow. Reducing the tin content to 2% in an alloy that contains 15% antimony reduces the hardness loss at high temperatures.

Additions of copper decrease the hardness loss at high temperature caused by aging and flow, simultaneously improving bondability. However, copper decreases the ductility and this is thought by some users to be undesirable.

The best of the lead-base babbitts is Alloy No. 407, conforming to the specifications for ASTM No. 10, which contains 15 antimony, 2 tin, 0.2% copper and the balance lead. This alloy is nearly the equivalent of tin-base babbitt except for bondability and ductility.

Additions of silver to lead-base babbitts produce further improvements beyond that obtained from a manipulation of the basic ingredients in lead-base babbitts. The improvements are in hot hardness and bondability, and are obtained without sacrificing ductility. By using silver in lead-base babbitts, it is possible to produce alloys either of greater strength and equal ductility or of equal strength and greater ductility, both with improved bondability.

The strongest of the alloys produced by the addition of silver is alloy No. 367, which contains 5% silver. This is 20 to 25% stronger than either the strongest lead-base babbitt or the strongest tin-base babbitt. Bonding of the silver-containing alloy was found to be far better than that of the straight lead-base alloy.

It is evident that silver performs a highly useful function in lead-base babbitts, and that silver-lead-base babbitts can be compounded that approach the properties of tin-base babbitt more closely than do the alloys now in use.

The cost of the alloy, in spite of the silver, is lower than that of tin-base babbitts, and although this is not important during a tin shortage, it would be under normal conditions. At 1941 prices the cost of the metals in tin-base babbitt is in the range 45 to 50 cents per pound, that of the 2.6% silver alloy is 21 cents per pound and that of the 5% silver alloy is 33 cents per pound.

The best of the lead-silver-base babbitts were chosen for further study. These two alloys were No. 367, which contained 15 antimony, 2 tin, 0.2 copper, 5 silver, balance lead, and No. 397, which contained 10 antimony, 3 tin, 2.6 silver, balance lead. In various tests these compared very favorably with the best tin- and lead-base babbitts.

While the new babbitt may not be the equal of a tin-base babbitt in all respects it is the equivalent in the more important bearing properties, and in the summation of properties approaches tin-base babbitt more closely than other substitutes whose properties are on record. It is believed that in the present shortage of tin this babbitt should have considerable use.

Comparative Properties of Tin-Base, Lead-Base and Lead-Silver-Base Babbitts

Alloy Type	Designation: Alloy No.	Designation: Spec'n.	Composition, %: Lead	Silver	Antimony	Tin	Copper	Brinell Hardness[1]: As Cast[2]	Aged[3]	Age and Test — 300 F.: 30 Sec	300 Sec	Ease of bonding	Ductility[4] %
Tin-Base	398	ASTM No. 2	—	—	7.5	bal	3.5	19	17	6.0	4.4	—	99
	399	ASTM No. 3	—	—	8.3	bal	8.3	20	20	7.2	5.5	—	91
Lead-Base	401	SAE No. 13	bal	—	10	5	—	21	17	6.4	4.0	—	—
	403	SAE No. 14	bal	—	15	10	—	26	18	6.5	4.2	—	53
	402	ASTM No. 8	bal	—	15	5	—	22	17	5.8	3.7	—	—
	400	ASTM No. 10	bal	—	15	2	—	21	16	6.4	5.0	poor	50
	407	ASTM No. 10	bal	—	15	2	0.2	18	18	7.1	5.4	fair	40
Lead-Silver-Base	366	— —	bal	5.1	15	—	0.2	22	16	6.0	3.8	—	—
	367	— —	bal	5.0	15	2	0.2	23	21	8.9	6.6	good	40
	368	— —	bal	4.8	15	5	0.2	25	19	7.2	5.9	—	57
	394	— —	bal	4.8	15	5	—	22	18	6.9	4.7	—	77
	397	— —	bal	2.6	10	3	—	21	18	7.2	5.2	good	59

[1] 2.5 mm ball, loads of 2 to 5 kgs. Load applied for 1 sec except where otherwise specified.
[2] Hardness measured after 24 hr at room temperature.
[3] Aged for 24 hr at 300 F.
[4] The ductility was measured by pounding down a specimen of standard size until cracking had occurred. The percentage reduction in thickness to cause this cracking is the figure given.

WARTIME POWER CLINIC

Practical ways to create emergency capacity. Cures for overloads, breakdowns, short-handed staffs, lack of spare parts, etc. Contributions invited at regular rates

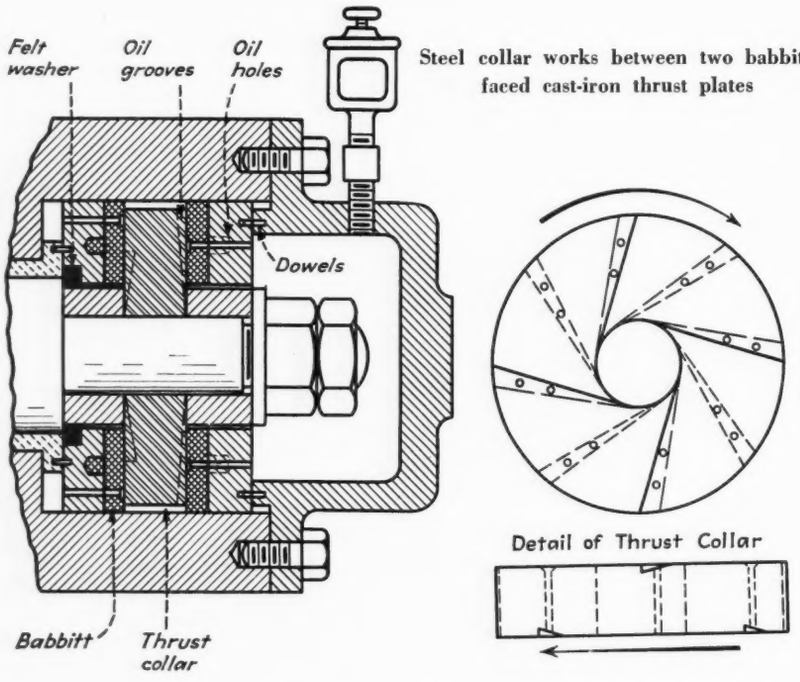
Cures for Troubles

Here are some more suggestions for solving the power man's wartime problems: homemade thrust and roller bearings, makeshift heater, relief valve and strainers for oil firing. Next month we'll show a piping trick that saved a long shutdown in a paper mill, also various furnaces to melt brass, bronze and babbitt.

Have you something to contribute to future "Clinics"? How about examples of piping changes that saved material or outage time? What are you doing to keep overloaded boilers and furnaces on the line? Have you some high-speed repair job to report, or a repair job finished without the usual tools, materials or spare parts? What new maintenance methods have prevented breakdowns despite war loads? Is war production overloading air compressors and air lines in your plant? What are you doing about it?

This department is a place to report cures for wartime plant troubles and it's also a place where you can air your troubles on the chance that some other reader may know the cure.

PHIL SWAIN



Steel collar works between two babbitt-faced cast-iron thrust plates

Homemade Thrust Bearing

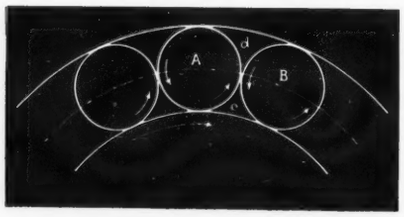
HERE IS A SUGGESTION for emergency replacement of a ball-bearing thrust. The design is well within the capacity of the average small machine shop. Note that the steel thrust collar is clamped tight to the shaft between two sleeves. The collar is grooved and drilled as shown to facilitate free oil flow.

Bearing against the thrust collar on both sides are babbitt-faced cast-iron thrust-plates. These plates make a sliding fit in the housing and are dowelled as shown in the sketch, one to housing cover, the other to the shaft bearing.

As in most bearings, the aim is to maintain an oil film between faces. In this case the thrust collar, having oil grooves cut as shown, picks up the oil and tends to pull it into the clearance space, thus counteracting the centrifugal force tending to throw it off.

The clearance between the faces must be adjusted to the size and nature of the job. Lubrication should be assured as long as the oil supply in the bearing is kept at the proper level. As an extra precaution a lubricator may be added as shown to the top of the housing to maintain a slow drop feed if necessary.

Kearny, N. J. GEO MCNALLY



Roller A will try to roll under roller B at c, while roller B will try to roll over roller A at d. The surface speed of the two in contact is twice as great, and the resistance four times as great, as that of a roller rolling against the edge of the roller box in a caged bearing

Doesn't Like Cageless Bearings

MAY I CALL ATTENTION to what I regard as a basic error in the article, "Emergency Roller Bearings," June POWER. In your sketches and description you discuss only that bearing in which the rollers practically fill the entire space, so that no cages are necessary. You further state, "In general, the circumferential clearance will be satisfactory if the diameter of the inner race is increased over the theoretical figure by approximately 0.002 or 0.003 in. per inch of pitch diameter.

Taking the second as a correlative of the first, I must question both statements. Even at moderate speeds a spacer cage safeguards operation of a roller bearing; at high speeds it is absolutely indispensable to prevent noise, heating and binding.

By using balls from old broken-up bearings, I have made several ball thrust bearings, some without spacer cages. Yet, even here I found that, for high speeds, a spacer cage made by drilling holes in a washer slightly thinner than the balls, improved operation. Because of the small area of surface contact of ball against ball, omitting the cage is passably acceptable for ball bearings. But because of the much greater area of contact, such design is impracticable with rollers.

Any given roller tends to rotate in opposite direction to the rollers it rubs against ahead and behind it, as shown in the sketch. Since these rollers are also being rotated counter-shaftwise by the shaft, there is an excessive amount of friction, accompanied by a tendency of each roller to roll under the one

ahead of it and over the one behind. If the rollers were made of an anti-friction metal, or even if each roller made contact with a roller of different metal, this might not produce such unfavorable results.

Even removing one or two rollers, to allow ample clearance, does not mitigate this tendency to reverse rotation, as might be expected. And the more the rollers wear and the higher the speed, the more pronounced this tendency becomes. This is why a spacer cage is a practical necessity for roller bearings operating at the speeds common to most machines.

I didn't like the subhead about roller bearings being easy to make. With the equipment I had available, that one wasn't. Besides, it ran warm and noisy although it did last about fourteen months at 350 rpm. I don't think that even an inexperienced rookie would have mistaken it for the factory-made product.

Menard, Ill. GEO HOLMAN

(It seems reasonable, as Mr Holman points out, that a cageless roller bearing should have more friction than a bearing in which the rollers are kept apart by a cage. On the other hand it is hard to reconcile his statement that "a spacer cage is a practical necessity for roller bearings operating at the speeds common to most machines" with the fact that several manufacturers have for years been marketing high quality "needle bearings" without cages. These have a large number of small-diameter rollers in direct contact with each other, running as shown in the sketch. Such bearings are not cheap or makeshift in any sense; they are offered as standard equipment for high-grade machinery, presumably including machines that operate at fair speeds. Readers having experience with "needle" bearings are invited to comment—EDITOR)

Roller Bearings for 1800 rpm

BECAUSE MANUFATURERS CANNOT keep up with the demand for their bearings these days, many users must make their own. My experience indicates that passable roller bearings are not too difficult to make, using drill rod for the rollers. Drill rod is uniform in size and roundness and can easily be hardened and tempered like any other high-carbon steel.

The shaft shown drives a wood drill running 1800 rpm, and was originally provided with two ball bearings as indicated. Space was limited, so I had to make the roller bearing as small as possible. I also had to true the shaft and provide end stops to keep the rollers in place. All three problems were solved by turning depressed races in the shaft as shown. These were made $\frac{1}{16}$ in. longer than the rollers, which were cut from $\frac{1}{8}$-in. drill rod.

Inside diameter of outer shell or housing must be inner-race diameter, plus two roller diameters, plus clearance. To avoid distortion, the outer part of the housing was milled (from a large block of cold-rolled steel) to the bracket form shown in Fig. 3 before the interior race surface was bored and ground to size (with a tool-post grinder).

It would save a lot of milling to use a simple steel shell for the outer race and weld on mounting lugs. If this is done, complete the welding before hole is bored and ground to size.

Two end rings to retain grease and keep out dirt were machined from $\frac{5}{8}$-in. steel washers turned to fit freely on the shaft. These were fastened to the shell with countersunk screws. Enough rollers were used to fill the space around the shaft without forcing.

If oil is used in such a bearing it should be fed from an oil cup or an automatic oiling system. If grease is used it should be very light. Avoid too much grease as it will cause heating. Flush out grease-lubricated bearings every few weeks.

This particular bearing was not hardened, yet showed no wear after 500 hours of operation. One advantage of this design is that wear can be corrected by making new rollers of the next larger size of drill rod ($\frac{32}{32}$-in. larger), taking a light cut from the inner and outer races to true the surfaces and fit them to the new rollers.

To assemble the bearing use some cup grease on the shaft to hold the rollers in place while sliding the shell on.

Warren, Pa. HARVEY E OSGOOD

Rough-and-Tumble Boiler Plant

ABOUT TWELVE YEARS AGO, when prosperity was "just around the corner," I got a job with a road construction company, tending their power equipment for mixing road-surfacing material.

The chief requirement for this job was ingenuity. From sheer necessity, most of the needed material for firing was home made and the rest just bought at a junk yard. However, the outfit (Fig. 1, pg 94) gave remarkable results and I feel that in these "hard-to-get"

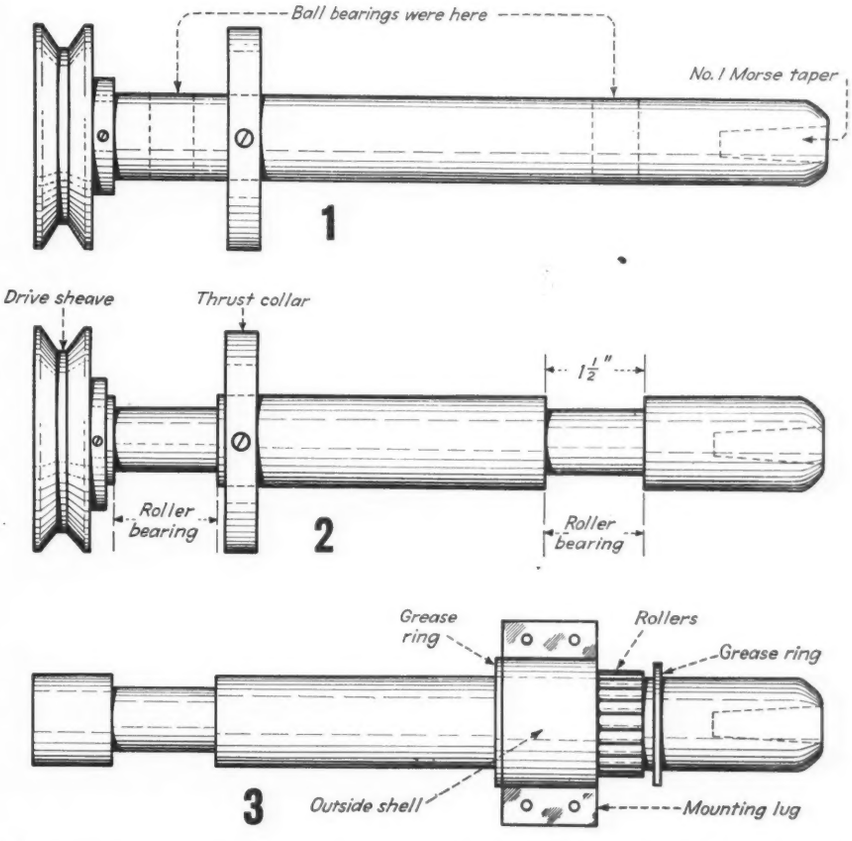


Fig. 1—Shaft runs at 1800 rpm and was originally fitted with ball bearings as indicated. Fig. 2—Depressed surfaces turned for inner races were made 1/16-in. longer than rollers (cut from ⅛-in. drill rod). Fig. 3—Completed bearing partly assembled

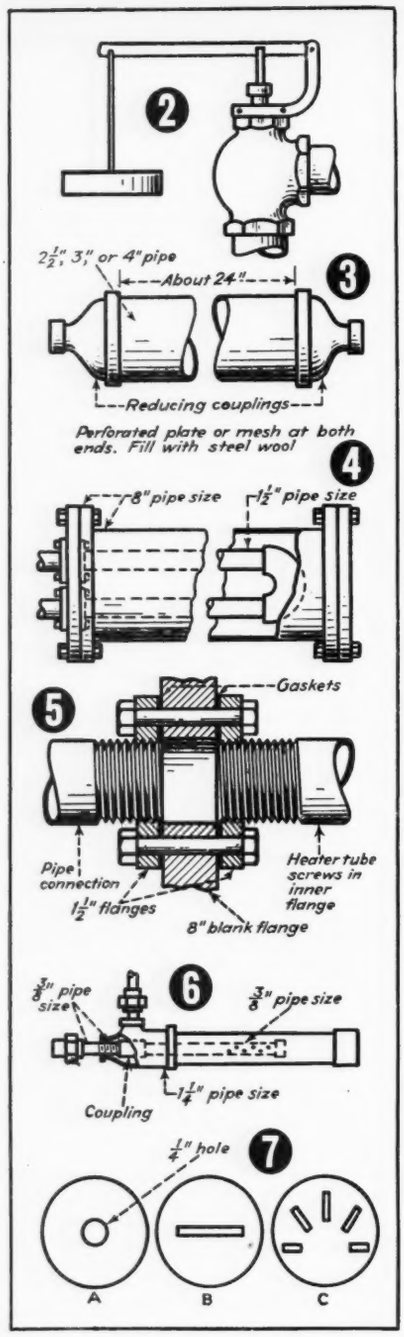


Fig. 1—General layout of the plant. Relief valve, burner, strainers and heater were homemade

Fig. 2—Relief valve made from an old angle valve

Fig. 3—Two reducing couplings and a piece of pipe made a strainer

Fig. 4—Oil heater was assembled from large and small piping and flanges (plus a return bend)

Fig. 5—Detail of connection in Fig. 4

Fig. 6—Burner, also, was made completely from threaded pipe fittings

Fig. 7—Of these three burner-cap opening patterns, C proved most satisfactory, giving a short flame suited to the boiler

times this strange procedure might be worth looking into.

I made the relief valve (Fig. 2) from a 1½-in. angle valve by filing off the stem threads and adding yoke, lever and weight as shown.

We used three strainers, as shown in Fig. 1. Perhaps the one next to the boiler should be called a "pressure chamber." Fig. 3 shows the construction. Not having steel wool, we bought "Chore Boys" at the nearest grocery store to fill the strainers.

We made the heater (Fig. 4 and 5) from two 8-in. pipe flanges, two 8-in. blank flanges, a section of 8-in. pipe, two pieces of 1½-in. pipe with a return bend, and four smaller 1½-in. flanges.

The burner (Fig. 6) was made from a reducing tee, a 1¼-in. cap, a ⅜-in. cap, some ⅜-in. pipe and 1¼-in. pipe —and necessary valves and unions.

Because we had no welding torch, everything had to be drill-and-tap work. Tank, pumps and secondhand pipe were bought at a "secondhand material shop"—polite name for a junk yard.

Many improvements could be made on this layout. For instance, a heater of welded construction would be better, and for those fortunate enough to have the material, a heater with a copper coil (as shown in the article by J S Kernachan, POWER, May, 1942, pg 98) would be fine.

Heating coils could be installed in the tank instead of circulating the heated oil back to the tank through a bypass.

We found that a burner cap cut in pattern C (Fig. 7) gave a shorter, more bunched flame, most suited to the short firebox of our locomotive-type boiler. Form *A*, with a ¼-in. round hole, gave too long a flame, while *B*, with a horizontal slot, gave a flat spreading flame. The overall length of burner was about 18 in., but anyone wishing to try this design must be governed by his type of boiler and the thickness of wall at the opening where burner is installed.

Drilling holes and capping the inside oil line of burner is not entirely necessary. We simply found that it helped the steam-oil mixing to quite an extent.

We used 1¼-in. pipe outside of burner and ⅜-in. inside, and found it worked very well for upward of approximately 2,000 lb of steam an hour. However, the measurements can just as well be ½ in. inside and 1½ in. for the mixing chamber. Similar changes can be made in other parts shown. The burner is of the inside-mixing type, long used in the oil fields.

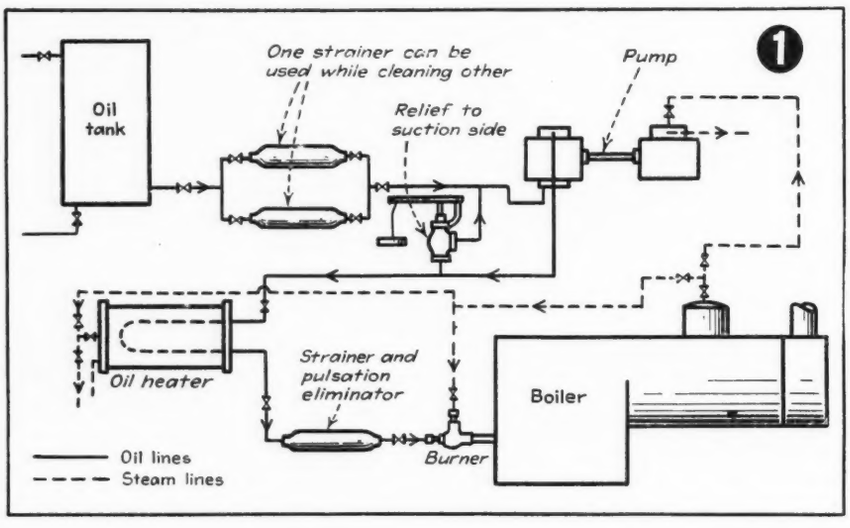
Aurora, Colo. EDWARD J DUFF

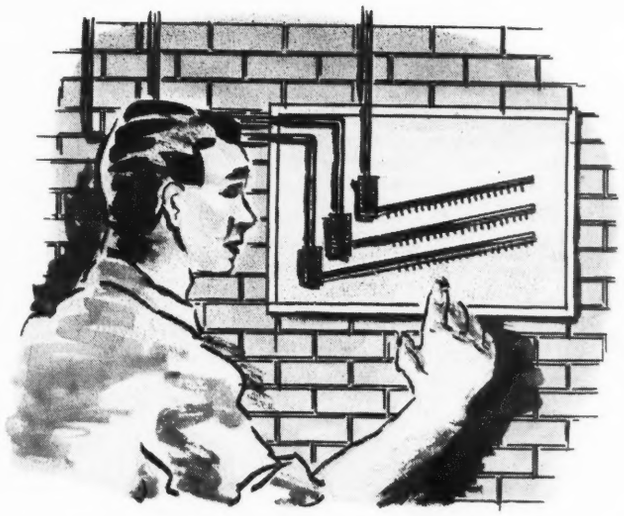
Check These

During these days of trying to get every last Btu or kilowatt out of the plant, try these:

1. Check boiler settings for leakages.
2. Check exit-gas temperatures.
3. Check soot blowers and use them systematically.
4. Keep soot-blower valves closed tight when not in use.
5. Fix leaky traps.
6. Feed boilers at steady rate.
7. Check combustible in ash. Maybe cleaning fires at a different time would help.
8. Keep feedwater hot.
9. Check closer on the quality of your feedwater.
10. Are all boiler baffles tight?
11. Are you maintaining the best CO_2? If you have a CO_2 meter why not check it with an orsat?

Wells College I W DUDLEY
Aurora on Cayuga, N. Y.
Chief Engineer





". . . the first multiple draft gage I ever saw . . ."

The Old Chief

21—Intelligent Anticipation

Another in the series by William Doran, chief engineer, Essex County Sanatorium, Windsor, Ontario. Writing of the inspiration of the past, he has captured much of the human side of engineering that lies beneath the maze of power costs and the wavy lines on paper disks

▶ A POWER MAN does not have to be very old to recall the days when automatic control devices, recording meters, combustion controls, warning signal systems, etc., were quite unknown in the average plant. The old-time guardians of the company's purse strings were inclined to set a very stern face against the purchase of what they regarded as "poppycock gadgets", and labor-saving equipment was viewed only in the light of the existing labor market.

The first multiple draft gage I ever saw was made by the Old Chief and the magic liquid in the inclined glasses was coffee. Then there was the speed-control system which he made out of a standard copper closet float and a balanced "quick-opening" valve. This float regulated the speed of the feed pumps to the water level in the receiver tank and was a boon and a blessing to the boiler operators. We did not have automatic damper control, but the dampers were moved by a large sprocket wheel and chain. The approved method of checking the draft was to remove the holding pin and move the wheel back a few notches until the firebox smoked back and then open the dampers until it just cleared.

The Human Element

When so much control was left in the hands of frail humans, with all kinds of distractions around them to lure them into forgetting that they had opened this valve or closed that switch, one would imagine that the men in charge of the outgoing and incoming shifts would have a big story to tell one another when they met. Well, for years I was present when Bill Gibbons handed over the shift to Tom Hogan and I assure you that their conversation was very meager. At 5:45 a.m. Tom would appear at the foot of the stairs.

"Morning, Bill." "Morning, Tom". Then Tom would glance at the report sheet, while he mentioned the weather, and the forecast according to that crazy morning paper. Bill would start donning his overcoat; Tom checked the gages, then would holler, "So long, Bill, hurry back soon." Bill would start up the stairs and say, "So long, Tom, don't blow the roof off".

Morning Ritual

Morning after morning this ritual was repeated with seldom a change in its timing or wording. There were of course exceptions, such as on the morning when we came to work and found the night gang working their heads off to repair a set of shaker grates that had foundered; or the morning when the coils in the heat exchanger went hay-wire and flooded the return system. On such mornings both shifts would continue working until everything was shipshape again. When the job was completed, the Old Chief would be the blackest, dirtiest, and most dishevelled person in the crowd. They tell me that if such an accident were to happen in the new plant, the maintenance gang would take over the job and the spotless, white-coated lords of the power house would be quite annoyed at the dust created by those "repair fellows."

I would like to raise my hat at this time to the Old Chief as the best exponent of the fine art of avoiding trouble that I have ever met. No matter how much plant expansion and normal repair work might tax his attention and almost his reason; no matter how harassed he might be by front-office interference or by some hitch in his efforts to build up a capable organization in his department, never for a moment did he relax his attention to routine inspection of every potential trouble source in the plant. A simple card system recorded the nameplate story and tag number of every motor in the shop. Once each year the rotor was removed, the windings shellacked and a careful note made of the clearance, top, bottom and sides. All terminals would be cleaned and tightened, special attention going to ground connections.

Crank On Valve Setting

All fans, sump pumps, magnetic switches would also rate a card which showed, in addition to the other information, the number of spare parts on hand and the tag numbers with which they were interchangeable. This card system was in regular use in making out the daily work sheets. The larger pump and engine overhauls were done as time and circumstances allowed. The Old Chief, like most old marine men, was a crank on valve setting.

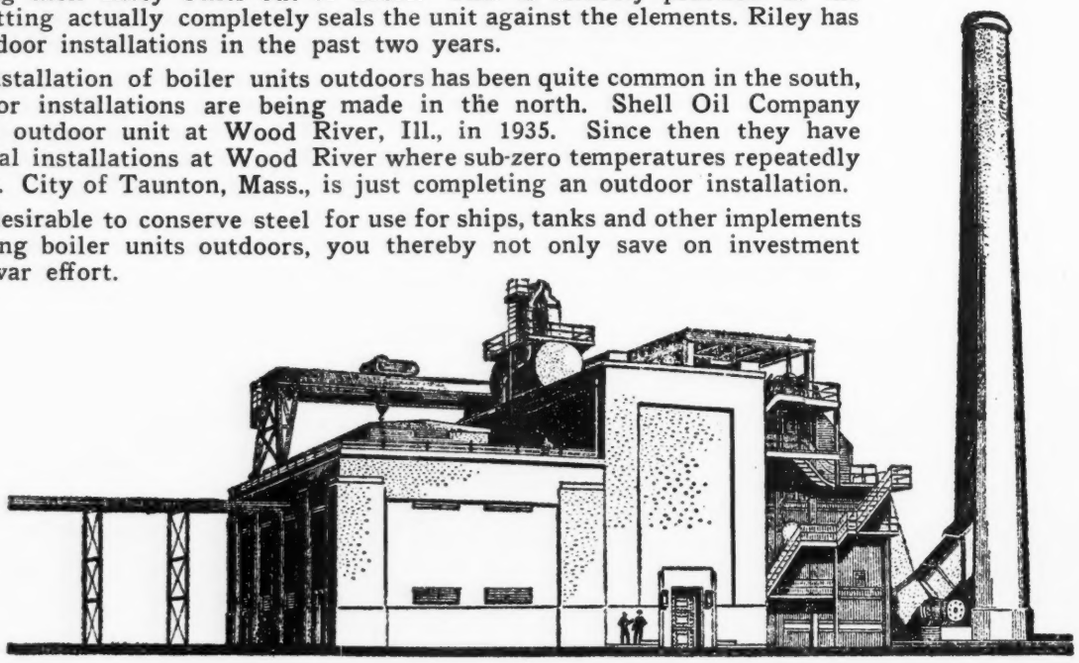
He would let any "plug" auto mechanic adjust his car. He would trust any "green" man to service the dynamo. He would accept anyone's orsat or meter readings. But when it came to valve setting, I doubt if he would have accepted a valve setting that had been declared perfect by a committee composed of Watt, Stephenson and Corliss.

Save building steel and money

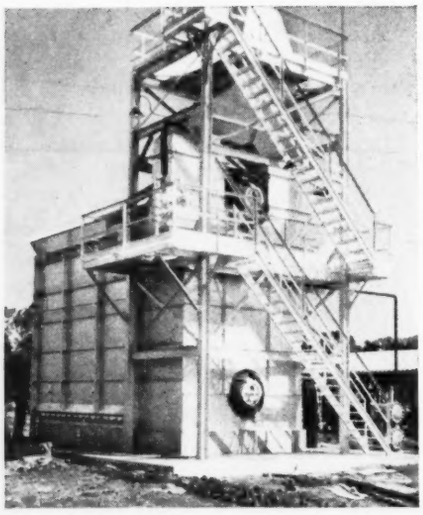
In order to save the expense of a building to house their boiler units, many companies are installing their Riley Units out of doors. This is entirely practical as the Riley Insulated Setting actually completely seals the unit against the elements. Riley has sold over fifty outdoor installations in the past two years.

While the installation of boiler units outdoors has been quite common in the south, today many outdoor installations are being made in the north. Shell Oil Company installed their first outdoor unit at Wood River, Ill., in 1935. Since then they have made four additional installations at Wood River where sub-zero temperatures repeatedly occur in the winter. City of Taunton, Mass., is just completing an outdoor installation.

Today it is desirable to conserve steel for use for ships, tanks and other implements of war. By installing boiler units outdoors, you thereby not only save on investment costs but aid the war effort.

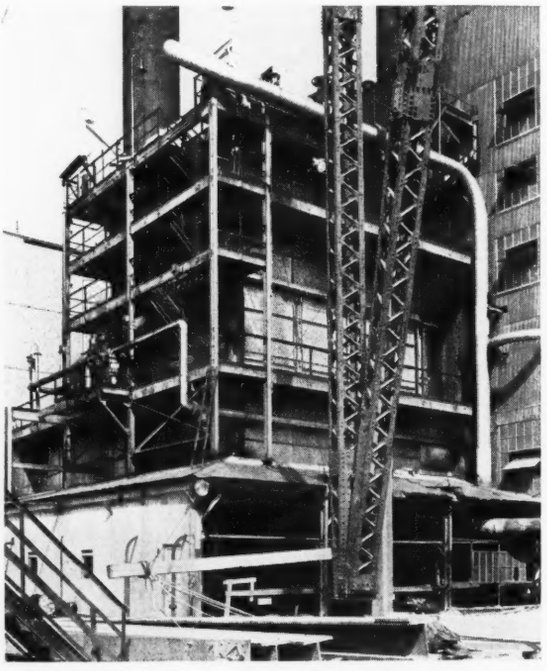


400,000 lbs./hr. Riley outdoor steam generating units being installed at Houston Lighting and Power Co., Houston, Texas. A 250,000 lbs./hr. Riley outdoor installation was made in 1938. The firing aisle of the unit is housed by the turbine room.



This 40,000 lbs./hr. Riley Steam Generating Unit is completely outdoors, even the firing aisle is not housed. A second unit was installed a year later.

Humble Oil and Refining Company installed a 350,000 lbs./hr. Riley outdoor unit housing only the firing aisle in 1936. A second unit was installed last year.



TRADE MARK Rx REGISTERED

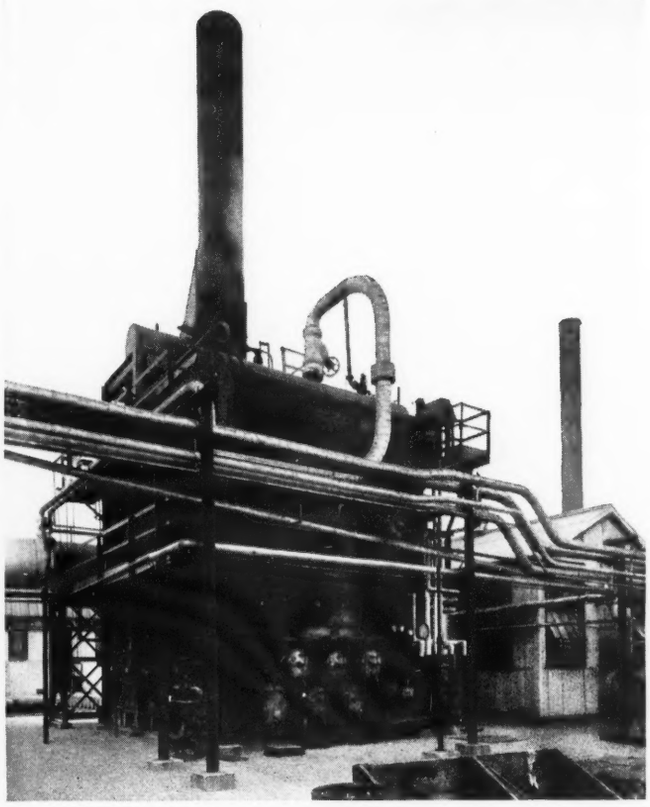
RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Pittsburgh Baltimore Buffalo Cleveland Detroit Chicago St. Louis Cincinnati St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis Richmond

It will pay you to visit modern Riley Installations

install Boiler Units outdoors



A Few Riley Outdoor Installations

Shell Oil Company
City of Taunton, Mass.
Houston Lighting and Power Co.
Humble Oil and Refining Co.
Florida Power and Light Co.
Dow Magnesium Co.
Carolina Power and Light Co.
Publicker Commercial Alcohol Co.
Abercrombie Company
Standard Oil Company of Louisiana
International Minerals and Mag. Co.

Shell Oil Company installed a Riley Steam Generating Unit completely outdoors in 1935. As is apparent from the photograph not even the firing aisle is covered.

When Shell Oil Company extended their boiler plant they installed Riley Steam Generating Units outdoors, merely extending the building over their coal handling equipment and the firing aisle.

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • AIR HEATERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • FLUE GAS SCRUBBERS

before purchasing Boiler or Fuel Burning Equipment

Ingenuity and Junk Pile Build a Power Plant

By ARTHUR PALME

▶ YANKEE INGENUITY conceived and built this waterwheel three years ago in Stockbridge, Mass. Its main wheel comes from a hay rake, obtained in a junk yard, with buckets made from old automobile headlight reflectors. Three auto "cemeteries" had to be visited before the required number of identical, undamaged reflectors were gathered. Each reflector had to be patched at its apex to close the lamp hole. Each was fastened to the periphery of the wheel by its original bracket and given three coats of paint. Some balancing of the wheel with blind rivets was necessary after assembly.

On the wheel shaft the internal gear came from part of the hay rake while the other multiplying gears were picked up in junk yards and assembled in good mesh between two steel side plates and carried on self-lubricating sleeve bearings. Over-all ratio of the assembled gear train is 1 to 12.

A large sheet-steel trough leads water to the buckets under about 3-ft head. With a higher hydraulic head and the water taken through a nozzle to the buckets, much more power could be generated. Under full head of water the wheel runs at 150 rpm, driving, through a flat belt, an automobile generator to charge in daytime a 6-volt battery that supplies a few 6-volt lamps and operates a radio at night in the home of the ingenious Yankee.

MORE POWER FROM EXISTING EQUIPMENT—6

Practical suggestions for increasing capacity quickly and with minimum use of strategic materials

SAVE STEAM to Boost Boiler "Capacity"

By L N ROWLEY
Associate Editor

When war loads demand more steam than your plant can produce you can meet the situation by cutting steam wastes. Here are practical ways to do it. Net result: you keep the wheels turning, pay for less fuel and help take load off the overworked railroads

IF you're in the spot most power engineers are in, you need more steaming capacity. You've tried every means of increasing boiler output (see POWER, Jan, pg 99; Feb, pg 57; March, pg 71; May pg 80) and you still need more. It looks as if the only answer is a new boiler.

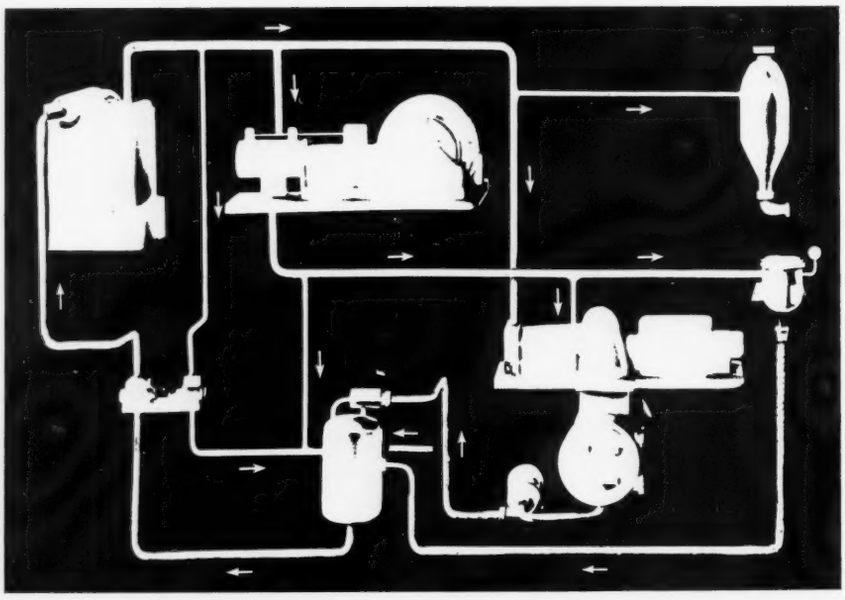
If yours is an average plant, the only way you can get a new boiler today is to build it without steel or other strategic materials. And that's just what you do when you increase *effective* boiler capacity by eliminating steam waste. Every reduction in steam consumption makes just that much more of your existing boiler output available for necessary power and process uses. You get the equivalent of new boiler capacity, you get it without benefit of priority, and you get it without waiting for delivery.

There isn't a plant in which no steam is wasted. In all too many plants, excessive steam consumption, failure to utilize steam and process heat to best advantage, and actual waste take an astonishingly large portion of boiler output, output that is vitally needed for today's war production.

Eliminating waste is always good business, but today it is a necessity and a duty. Steam saving means lower power-plant costs, of course, but even more important, it saves fuel. It may make the difference between full-load operation and partial shutdown caused by shortage of critical fuels. In any case, every steam saving represents a proportionate cut in the amount of fuel our overworked transportation agencies must handle in the days ahead and thus contributes directly to the winning of today's most important battle—transportation.

Take a look around your plant now. Not just a casual look but a searching one, not a smug look but an objective and cold-blooded one. Are you using every pound of steam to best advantage? Are you using more steam for power production or process than is absolutely needed to do the job? Are you actually throwing steam away through visible and invisible leaks?

Take a look around. You may find the equivalent of a badly needed new boiler—others have!



Use Steam to Best Advantage

► In most industrial plants, biggest opportunities for steam saving lie in substitution of exhaust steam or any other low-grade heat for precious boiler steam. Every change in hookup or method of operation that allows exhaust to be used for live steam makes available an equal amount of boiler capacity.

Steam saving, like charity, begins at home. Look first to your power-plant hookup. Does live steam heat feedwater where bleed or exhaust steam could do the job as well? If exhaust from steam-driven auxiliaries is all or partly wasted, can you substitute motor drive? Where possible, recover heat in blowdown, condenser circulating water or other hot water flowing to waste; this will release steam for heating that water can't do.

In like manner, check process steam requirements. For each use, find by trial or analysis what constitutes minimum temperature and pressure. If your plant is average, some processes can be switched, with perhaps some little inconvenience, to low-pressure or exhaust steam, releasing high-pressure steam for more important work.

If you waste steam to atmosphere or hot water to the sewer, the chances are that one of the above suggestions or other similar schemes will produce steam savings. As long as there is a chance to make low-grade heat do the work now done by high-grade, ingenuity can make a steam saving.

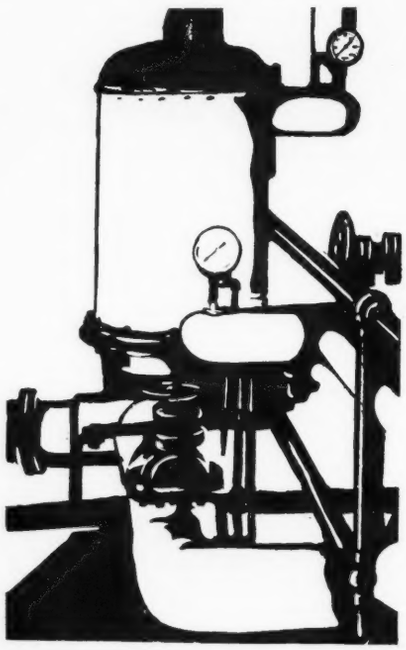
Steam used unnecessarily in the boiler room or engine room is steam that never gets to do its production job. If prime-mover steam rates are higher than they should be, a direct waste of boiler capacity results. Take indicator cards on steam engines regularly and maintain proper valve settings to keep steam consumption to a minimum. Deposits on turbine blades increase steam rate and decrease capacity. Some deposits can be removed by shutting down and allowing units to cool, by dropping steam temperature, or by washing. Removal of insoluble deposits usually involves opening the unit and air-blasting with flyash or other material that will not harm blade metal. Best solution is to stop deposits at source: prevent carry-over by water treatment and proper boiler operation. Worn turbine blades also cut down efficiency—silver soldering offers a practical means of restoring blade shape. Keep condenser clean and tight to insure high vacuum necessary to efficient prime-mover operation. One-tenth of an inch better vacuum means one-half percent less steam used.

Many possibilities for steam saving lie unsuspected in small auxiliaries around the plant. Valves in poor condition, leaky packings and glands and irregular operation boost steam consumption of small pumps. Check condition and operation of soot blowers, steam-jet ejectors on ash- and dust-handling systems, auxiliary-drive turbines and engines.

Schedule Loads

If peak load is high in relation to average load, examine the time cycle and absolute necessity of every load that contributes to the peak. Many kinds of process equipment, digesters for example, operate intermittently and involve extremely heavy steam loads for starting. Arranging to stagger operation of such units can materially reduce peak loads; staggering can be effected by developing a schedule for operators, and seeing that it is enforced, or by automatic program control. Such scheduling requires cooperation among production departments; experience shows that it can be done without interfering materially with production.

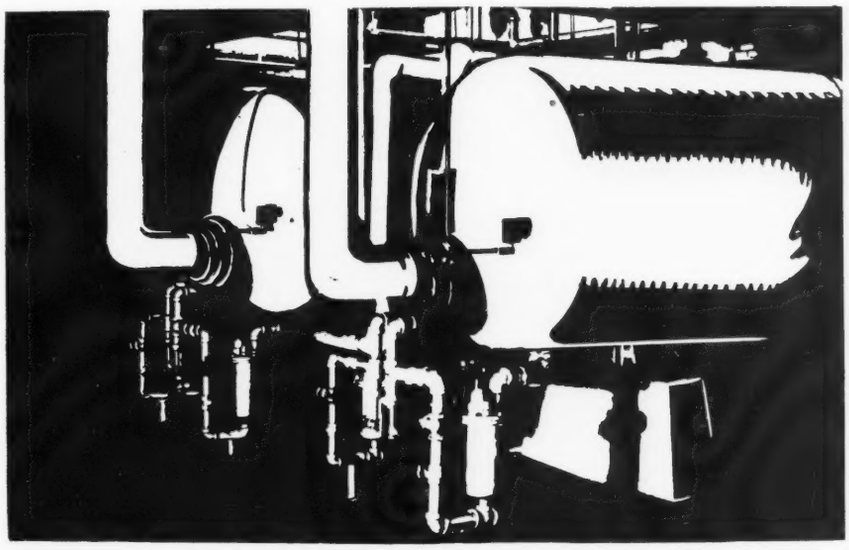
After possibilities of scheduling have been explored, see if some loads can't be cut off or reduced during the peak period. Look for units such as dryers, hot-water heaters and kilns that can operate with reduced heat input for a short time without great harm to the product. Hot-water heating in particular, if carried out on a large scale, can be used as a thermal flywheel to even out swings in boiler load. Where necessary, heating and air-conditioning equipment can be shut down during the peak period. Normally, storage effect will avert any drastic change in comfort conditions if shutdown period is short.



Plug Leaks, Reduce Heat Loss

► You can save a ton of steam every 24 hours by stopping leaks equivalent to a ⅛-in. hole in a 120-lb line. Check pipe joints and packing for escaping steam. A wisp of steam showing at the atmospheric exhaust when the plant is producing no excess exhaust shows that the atmospheric relief valve is leaking—fix it. Recondition any other valves that pass steam when shut (if pipe beyond stays hot after valve is closed, valve leaks). Provide traps with test connections and test regularly. Check pumps, small auxiliaries and all process equipment for leaks.

Anything too hot to touch wastes heat. Overheated boiler rooms, engine rooms, pipe tunnels and process areas are common symptoms of excessive heat leakage. Insulate to save steam. Most forms of insulation are readily available, although there may be some difficulty with binding wire and other steel accessories. Ingenuity will enable the engineer to get around these difficulties in most cases. Remember that the usual rules for determining economic application of insulation do not apply today; when you're out to increase boiler capacity by saving waste heat it may pay to insulate many places that would usually be left bare and to use even thicker insulation than normal.



Eliminate Process Waste

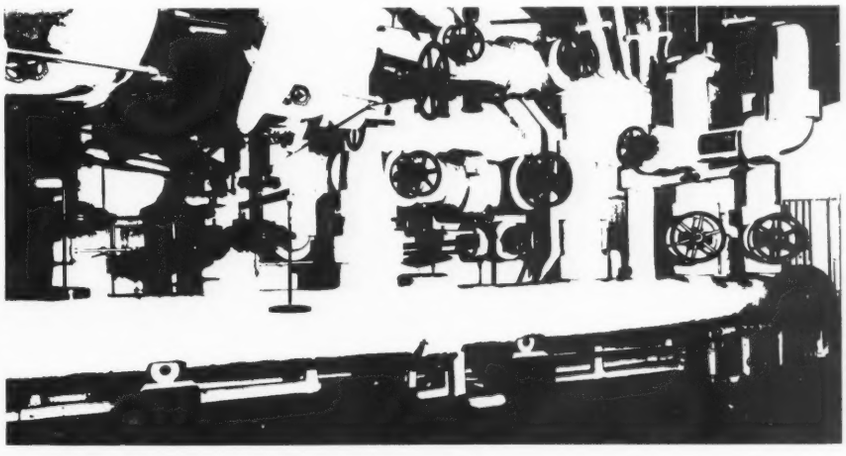
▶ Any industrial-plant engineer who has checked process-steam consumption against actual minimum requirements and taken steps to reduce waste will testify to attractive savings that can be made by an active working program to reduce process use. In your own plant, look first at processes where the operator controls amount of steam, hot water, chilled water, refrigerant, compressed air, or other power service. That in most plants all the power services stem back to the boiler and a saving anywhere means a steam saving.

Plain carelessness accounts for much wasteful use of power services, as does the operator's mistaken notions about how much steam, water, etc, is needed to do a given job. Training operators and encouraging economy by posters and pep talks offers a partial solution. The real answer lies in determining by actual trial what minimum amounts are sufficient and then installing some mechanical device to limit flow. Orifices have been used to restrict flow to kettles, vats, etc, and have worked well in many plants. Automatic valves offer a more complete answer.

Even after power-service consumption of each piece of process equipment has been reduced to a minimum, further savings can be made. Much process equipment, particularly older units, was designed without real attention to efficiency. In many such cases, simple changes in the equipment can improve operation and save steam at the same time. For example, changing location of heating surface in dryers and improving air circulation may reduce steam consumption as much as 25%. Incorrect piping layout and absence of needed traps causes steam waste on many process units.

Finally, keep process equipment in good condition. Responsibility for such maintenance is often divided or given to the production department whose major interest is all too often concentrated on getting the job done without regard for equipment condition. Dirty or scaled heating surfaces, defective insulation, leaky casings, valves and traps all add to steam load.

Not usually thought of as process-steam users, but important contributors to waste in many plants are house-service and water supply-pumps. The same rules apply: keep the units in good condition and watch for wasteful use. Cure the "running-water" evil by installing self-closing spring faucets, by checking faucets regularly for leaks and by testing flush valves for faulty operation. If a check shows that cooling or process water is left running after equipment is shut down, install automatic valves or emphasize to the operator his responsibility for turning off the supply. Examine every cooling-water use to see if a recirculating system can't be installed to save water. Double check all hot-water and chilled-water systems to be sure the extra value represented by heating or refrigeration isn't wasted. See if hot or chilled water, after use, can't be turned into sanitary or general-service systems where purity or temperature is unimportant.



Operate Heating System Efficiently

▶ Most heating systems offer major opportunities for steam saving that may bulk large in institutions, office buildings and factories where heating load is a large part of total steam load.

Start the steam-saving campaign by checking the entire building structure now, before the heating season begins. Arrange for closing wall and roof openings where possible and block unneeded windows. Check all windows: replace cracked or missing lights, double-glaze or add storm sash, caulk window frames, weatherstrip, set sash strips. Frequently used doors and openings to loading platforms lose lots of heat. Con-

sider revolving doors or inside vestibule for doorways; if possible, install partition with double doors between loading platforms and main part of building. Investigate possibilities of insulation on roof and walls of hard-to-heat areas. This will cut heat loss and will produce higher inside wall temperature, reducing body radiation and insuring comfort at lower air temperature.

Go over the heating system line by line and radiator by radiator. Remember that exposed heating-system lines need insulation: the comfortable theory that heat lost from bare lines all goes to heat the building anyway can be a fallacy, and insulation is needed to confine heat output to the places where it will do a useful job. Remove or block off unused lines and radiators—steam leakage through "tight" valves can represent a substantial loss. Check radiator sizing against room requirements and switch radiators to get best possible balance. Check pitch of supply and return lines and eliminate pockets. Inspect and place in good working condition valves, traps and air vents.

Arrange for Zoning

See if simple piping changes will permit at least a rough form of zoning. Where possible, divide system so that less steam can be supplied to sides exposed to sun and more steam to sides exposed to prevailing winds. Likewise provision should be made to reduce steam supply to areas where nature of work or other conditions make lower room temperatures practical and to permit individual operation of parts of system serving areas where hours of heating differ.

Lack of control results in overheating many buildings with consequent steam waste. Little or no equipment is required to correct this condition by simple manual control of steam-supply pressure. Set up a schedule of outdoor temperatures, showing corresponding steam pressures needed for adequate heating. The operator need only read an outdoor thermometer at intervals and adjust steam pressure accordingly making some allowance for wind and sun conditions. By adding an outdoor thermostat, this simple control arrangement can be made automatic.

To be fully effective, heating control by supply pressure should be supplemented by an orifice in the supply pipe to each radiator. Orifices are sized to insure proper distribution of steam among radiators. In an orifice system, pressure required to fill all radiators can be determined quite accurately; lesser pressure will fill them to a proportionate amount. Other control systems depend on intermittent steam supply or on variation of pressure below atmospheric (see POWER, April, 1941, pg 86–88).

A major part of heating system routine operation should include a regular check of all heated spaces to see that windows and doors are closed and that radiators not in use are shut down. Where entire areas are unoccupied, shut off the system at the control point nearest to the boiler or main supply line, so that heat is not lost from steam in risers and supply lines. Where buildings are unoccupied at night, reduce temperature or shut down during this period, depending on heat storage of building and freezing hazard. During the day, operate at lowest possible temperature; this often proves to be less than "normal" temperature.

Install Meters to Insure Savings

▶ Meters do a double job in the steam-saving program: not only do they contribute directly to eliminating waste but they provide a measure of results obtained and a means for insuring continued minimum-waste operation.

A meter for each major power service to each major consuming department constitutes a practical minimum. A charge to department for its actual consumption acts as a powerful lever in the campaign to eliminate waste. Production foremen and department heads, always working with a weather eye to costs, "put the heat" on operators to conserve and see to it themselves that equipment and methods are such as to reduce steam use to a minimum. Furthermore, you can use meter records to track down sources of waste; they give you the basic facts on which to plan a waste-reduction program.

A steam-saving campaign may start off with a bang, with every one keyed to the proper pitch for maximum efficiency. Then, as time passes, interest lags and the various factors under the control of individuals begin to show a return to former conditions. Without meters this slackness passes unnoticed. With intelligent and continuing records, any falling off in performance becomes noticeable immediately and corrective measures can be applied. Meters insure long-term success of waste-elimination programs.

The above items represent typical ways to reduce steam consumption and thus to increase *effective* boiler capacity. They will work; they have worked in many plants. They do not represent all the ways to effect savings—not by a long shot. Each plant offers savings opportunities peculiar to itself and its own special conditions. It's up to the individual power engineer and his staff to ferret out the many other possibilities that lie hidden in each plant.

One practical suggestion: ask the power enginer from some neighboring plant to look over your setup and offer to do the same for him. Looking at things from a fresh viewpoint, he will notice many items that long familiarity has made you accept as fixed and unchangeable. There may be a good reason for supplying live steam to the dryers and letting exhaust blow out the roof, but he'll make you prove it. And if there isn't a good reason, he'll prod you into doing something about it. In the same way, you can do a useful survey job for him. Try it, it's a worthwhile form of engineering cooperation.

New Facts About Embrittlement

Boiler drums and tube ends can be protected against intercrystalline cracking by chemical treatment of feedwater, but no single, simple cure-all has yet appeared. A report prepared by* POWER *from a bulletin by W C Schroeder and A A Berk, U. S. Bureau of Mines*

▶ INTERCRYSTALLINE OR embrittlement cracking of boiler steel is caused by the action of water containing small amounts of caustic as it seeps into and through boiler joints and seams. The attack produces a peculiar network of hairline cracks around the crystal grains of the steel which leads to eventual failure of the joint, possible explosion of the boiler, and attendant serious damage to adjacent property. Costly repairs or a new boiler may be needed to replace one which has suffered embrittlement cracking, and in any event serious interruption in steam production results from such damage.

Two methods might be employed for eliminating embrittlement in boiler drums; these are, to build boilers in such a manner that they are not susceptible to cracking or to treat the water so that it will not cause cracking.

Welded-drum construction has eliminated riveted seams which were most prone to cracking. Rolled tube ends remain as possible sources of trouble but if the cracking is confined to the tubes and does not extend to the ligaments of the boiler, the cost of repairing the damage is comparatively low. Also, tube-end cracking results in no explosion hazard such as does drum cracking. Welding of drums, therefore, is a satisfactory means of eliminating the major source of trouble in stationary boilers. General adoption of welded construction for locomotive boilers is not yet deemed feasible, however. It is doubtful whether riveted boilers can be built with absolute assurance that the seams are not susceptible to cracking.

For riveted locomotive and stationary boilers now in service, it is usually necessary to rely on water treatment to prevent cracking. Fortunately, information has been accumulated in research laboratories concerning the factors that cause the cracks, and means are being found for preventing them.

It is now known that three factors must combine to cause embrittlement cracking. First, the boiler water must contain caustic soda and, at higher pressures, silica. Most boiler waters do contain these materials. The caustic is present or added to prevent corrosion and pitting; silica is always found in the feedwater and cannot be economically removed.

Second, the dilute boiler water must concentrate. It does this by flowing into a very nearly tight seam and then losing steam to the atmosphere, Fig. 1. The leak is usually so slow that the escape of steam is not noticeable. Tests have shown that a new boiler with apparently perfect calking may allow sufficient leakage to form concentrated solution by this process.

Metal Must Be Stressed

Third, the metal in the seam must be stressed. This does not necessarily mean applied stress. Cold deformation during fabrication and riveting can create the stress necessary for cracking. Of course, the highly stressed metal must also be in contact with the concentrated boiler water.

On the basis of these fundamental principles it has been possible to develop an embrittlement detector that exposes a stressed test specimen to the boiler water in exactly the same manner as a riveted seam is exposed under operating conditions. The equipment shown in Fig. 2 can be attached permanently to a boiler, as in Fig. 3, to determine whether the boiler water can cause embrittlement cracking. Inasmuch as leakage and loss of vapor allow concentration of the boiler water in contact with a stressed area of the test specimen, the third factor—the embrittling tendency of the water—is the variable measured in the test.

The development of this test equipment has permitted thorough investigation of protective compounds under conditions closely related to boiler operation. The tests indicate that if steam diffuses slowly outward from a riveted seam, concentrated solution can ac-

* *For complete report send 15 cents to Superintendent of Documents, Washington, D. C., for Bureau of Mines Bulletin 443.*

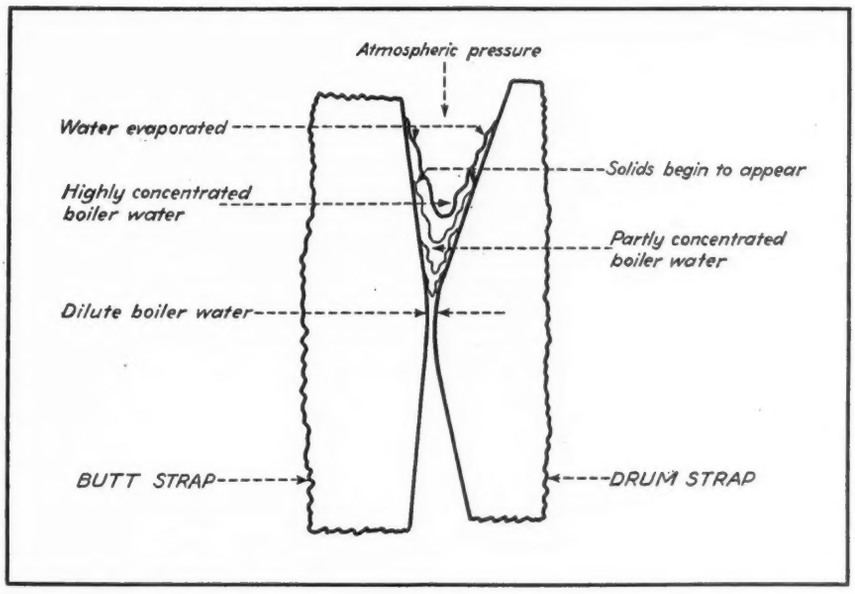


Fig. 1—Greatly magnified diagram of a leaky seam showing how concentration occurs where high-temperature high-pressure boiler water seeps to atmosphere

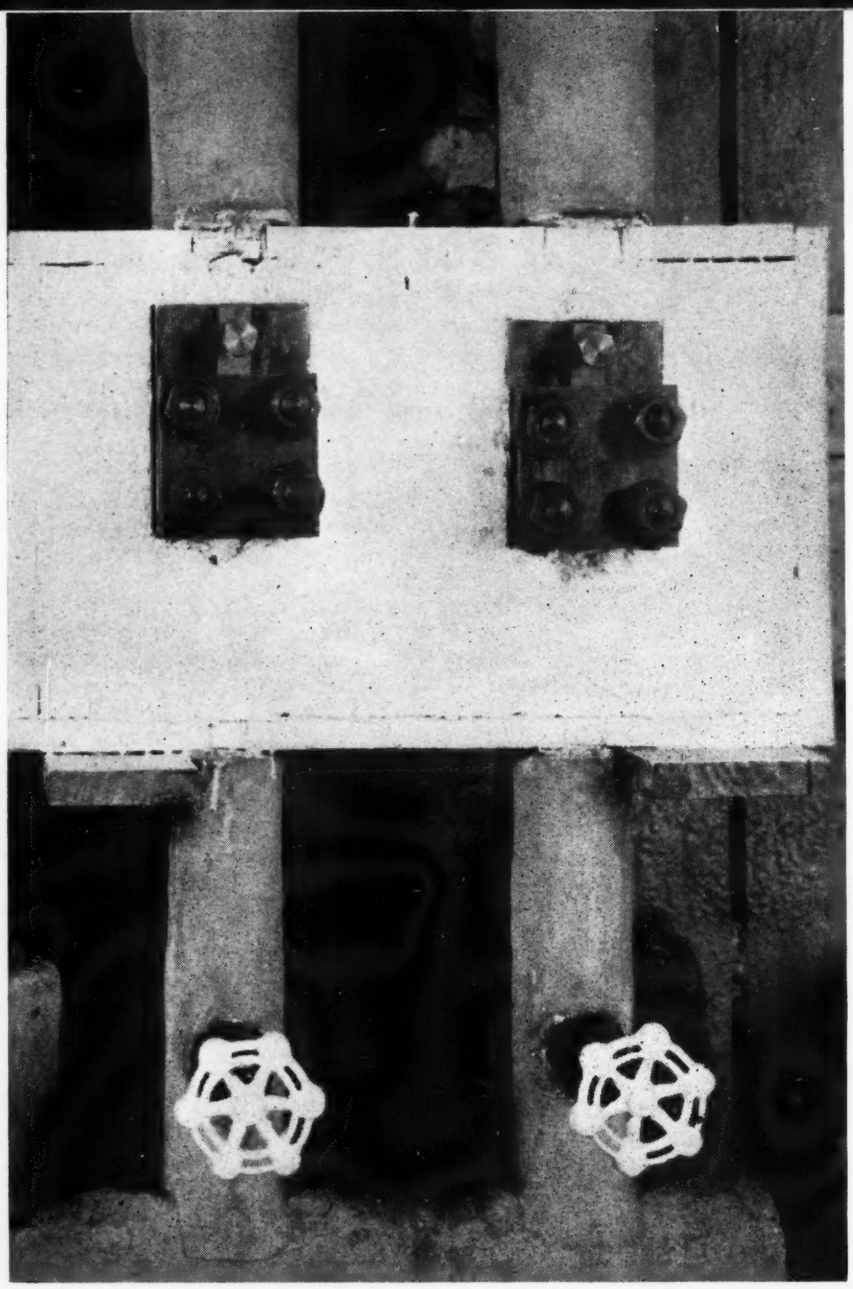


Fig. 3—Embrittlement detectors installed on a boiler provide two necessary factors, high stress and leakage. If the boiler water provides the third requirement, chemical attack, the specimen will crack

cumulate and cause cracking of the stressed metal. Sodium sulphate has not stopped this process, as shown in Fig. 4, even when it was present in an amount greater than four times the caustic.

Turning from the negative results on the protective qualities of sulphate, extensive laboratory studies have been made of a number of other materials which do show promise of preventive action. Of the inorganic salts, sodium nitrate has been used most successfully. It is not affected by other boiler salines and is relatively easily handled and controlled. It is now in use on the entire system of one large eastern railroad with extremely satisfactory results. The nitrate treatment on this road was shown to be effective through the use of 15 embrittlement detectors and, perhaps more significantly, through a very sharp decrease in engine cracking.

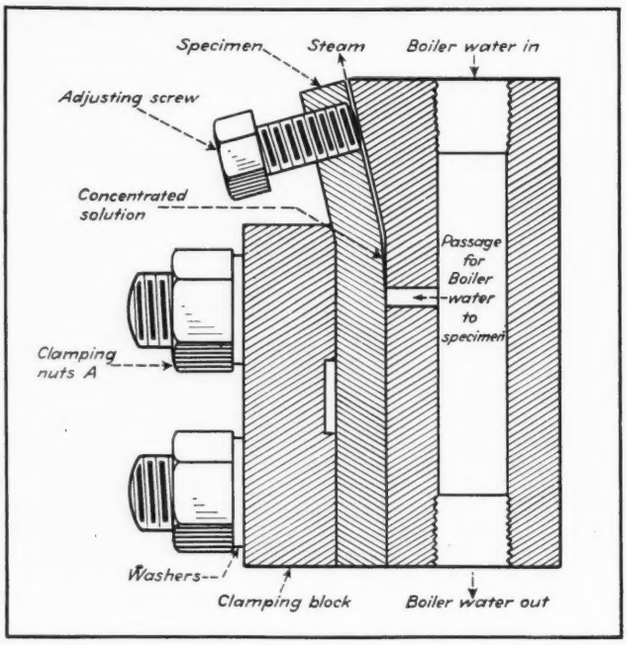
Organic Compounds

A number of organic compounds apparently prevent embrittlement cracking. Of these quebracho tannin and lignin-containing waste sulphite liquor are among the most useful, both from the standpoint of cost and the absence of undesirable effects in the boiler water. A method for the determination of these compounds given in an appendix to the Bulletin allows definite

Remember These Known Facts About Embrittlement

1. Three conditions must exist to make embrittlement possible (1) high stress in the metal (2) concentration of boiler water by leakage and (3) chemical condition of the water favorable to embrittlement
2. Welding drums and other modern practices greatly reduce probability of embrittlement by eliminating mechanical factors
3. Presence of an embrittling water in an operating boiler can be determined with reasonable assurance by installation of a detector directly on the boiler
4. No one chemical or method can be prescribed for all waters at all temperatures and pressures but effective protective methods have been developed for preventing embrittlement in the great majority of stationary and locomotive boilers
5. Several chemicals have already proved satisfactory in practice; further experience and testing now under way are aimed at selecting the best

Fig. 2—Construction of embrittlement detector for attachment to an operating boiler. The adjusting screw puts high stress in steel specimen. (Patent No. 2,283,955, May 26, 1942)



control of their concentration in the boiler water.

Quebracho, an extract of the South American tree of the same name, has prevented cracking in laboratory tests at pressures up to 500 or 600 psi. In this work high concentrations of inorganic salts, such as sodium sulphate, interfered with the protection. On the other hand, quebracho has effectively prevented cracking in plant tests at pressures up to 650 psi, even when high concentrations of inorganic salts were present. This indicates the desirability of continuous or frequent feed of the inhibitor, which was not possible with the laboratory apparatus. The use of this protective agent has been, in general, confined to stationary boilers, where it has created no difficulty with foaming or priming. It should be noted that quebracho has been used in boilers for many years to reduce corrosion by removing oxygen from the boiler water, and to help prevent the formation of hard scale.

Waste sulphite liquor, a byproduct of the wood-cellulose industry, is probably inferior to quebracho in absorbing oxygen and preventing scale formation. Both the liquor and lignin-containing derivatives have been used in locomotive boilers by a large number of railroads with satisfactory results. Tests with the embrittlement detector in most instances confirm this protective action when enough of the inhibitor is used. However, waste sulphite liquor has not proved to be completely effective under all conditions. In several cases a tendency to cause foaming and carry-over has been reported.

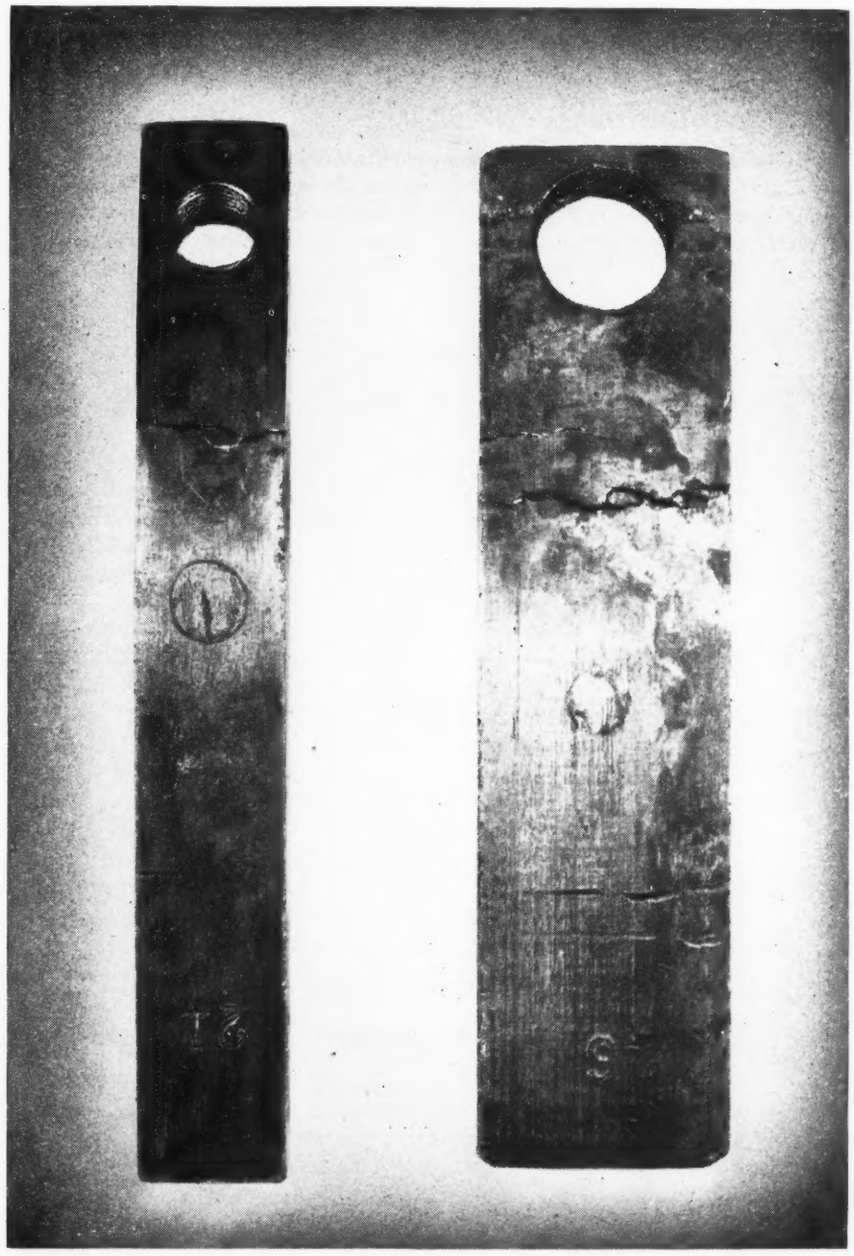


Fig. 4—Detector specimens cracked by (left) solution containing sodium sulphate and (right) solution with 2000 ppm sodium sulphate plus 500 ppm of sodium chloride. These illustrate failure of either sulphate alone or sulphate and chloride as protective agents

While these inhibitors were being tested, it was found that a more direct method of treating boiler water to eliminate cracking would be the removal of alkali which can concentrate to produce the trouble. On the other hand, the pH of the boiler water must not be allowed to fall so low that corrosion and pitting will occur. Sodium phosphate can be used to maintain the pH without introducing or permitting caustic soda to develop in the boiler water.

A series of laboratory tests indicated no cracking resulted in the absence of alkalies that yield strong hydroxide solutions when the water is concentrated by evaporation. The pH was maintained by the use of sodium phosphate. This latter chemical did not cause cracking in the detector tests.

The laboratory data is supplemented by a completely successful trial on one boiler, where use of full phosphate control of the alkalinity removed the embrittling tendency of the boiler water as demonstrated by the embrittlement detector. The boiler used evaporated makeup, and total solids in the boiler water were considerably reduced because no caustic and sulphate were added to the feedwater.

It should be emphasized that sodium phosphate is not an inhibitor of embrittlement cracking. When it replaces sodium hydroxide as the source of alkalinity, it removes the necessity for an inhibitor.

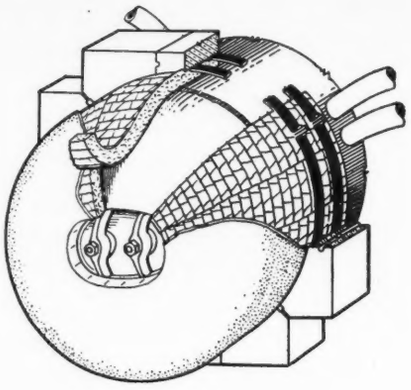
Results of Tests

Available results are already a great deal more comprehensive than previous work. They have shown disconcerting deficiencies in the action of some chemicals that have been relied on to stop embrittlement. At the same time they have revealed more effective protective methods which interfere with other phases of boiler operation to a less extent than previous methods. Work now under way should develop convenient and sure protective methods.

The authors of the bulletin do not emphasize any particular one of these methods for controlling embrittlement cracking. It may be that no one preventive treatment can be applied indiscriminately in all cases. In the embrittlement detector they have produced a means of measuring whether a boiler water can cause cracking and whether treatment to avoid embrittlement failure is effective.

Priorities Bring Innovations

Design engineers bring innovations into the power plant because of priorities on materials, says George P Reintjes



▶ PRIORITIES ON METAL and other strategic materials have necessitated the creation of new designs in power-plant equipment and accessories. Since metal plates for furnace packing are unavailable, previous designs that contained a metal plate within squaring tiles have had to be abandoned.

Air infiltration into the furnace between masonry walls and boiler drums can be prevented by a new construction which keeps the upper side walls of bent-tube boilers permanently aligned. The squaring tiles (partially shown) and the sectionally supported walls, below, between and above the drum, contribute to the efficiency of the process. Air infiltration in this area of bent-tube boilers has caused more wall failures and fuel waste than in all other portions of the boiler wall.

Ordinary boiler walls failed because of unstable face of foundation for upper side walls which is supported partially by an upwardly expanding brick wall. Part of this wall rests on a drum-supporting girder which lacks accumulative expansion. The boiler drums expand outward to an extent dependent upon the drum length. In addition, the upper side walls are weakened by openings necessary for drum ends, doors, superheater outlets, etc. These factors prevent the building of a stable wall.

End Seal For Drum

Air-sealed rings compress a 3-in. slag wool blanket, with expanded metal facings inside and out, into a 2-in. space. The same packing can be used as insulation for the drum ends by orange-peeling. Wire-mesh cover permits outward expansion of the drum ends and does not leave a gap between the drum insulation and the boiler wall. This insulation can be rolled back for inspection of the weld between drum and head.

Spot welding of nuts, wires, or other contrivances is unnecessary and consequent stresses in the pressure parts of the drum are eliminated. Furthermore, labor cost of installing the insulation is reduced to a marked degree.

✦ ✦ ✦

ASTM Lists Emergency Babbitts and Solders

▶ "EMERGENCY ALTERNATE PROVISIONS" in the specifications for soft-solder metal and for white-metal bearing alloys (babbitts), issued by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, provides formulas that comply with War Production Board tin-conservation orders. Except by special permission, WPB forbids the use of babbits containing more than 10 percent tin, or solders that have more than 30 percent tin.

Available combinations for babbitts are given in Table I and for soft solders in Table II. For each, the ASTM has printed an appendix (not reproduced here) listing hardness, melting ranges and pouring temperatures.

Table I—Emergency Babbitts; Percentage Composition

Alloy Grade	Tin, percent	Antimony, percent	Lead, percent	Copper, percent	Silver, percent	Arsenic, percent
No. 13	2.0	15	balance	0.25 max	2.5	.....
No. 14	0.75	12.75	balance	.....	...	1.5 to 3.0
No. 15	0.9 to 1.25	14.75 to 15.5	balance	0.4 to 0.6	...	0.6 to 1.1
No. 16	10	12.5	balance	0.4 to 0.6	...	.....
No. 17	6	10	balance	0.25 max	...	.....
No. 18	1.0	17	balance	0.4 to 0.6	...	0.8 to 1.4

Table II—Emergency Soft Solders; Percentage Composition

Alloy	Tin, percent	Lead, percent	Bismuth, percent	Silver, percent	Antimony, percent	Copper, percent
1	25	balance	0.5	0.5	0.5 max	.....
2	20	balance	15	none	.....	.....
3	20	balance	10	none	.....	.....
4	20	balance	3	1.5	.....	.....
5	15	balance	5	1.5	0.5 max	0.5 max
6	10	balance	5	2	0.5 max	.....
7	0.65 to 0.85	balance	none	0.25	.....	.....
8	none	balance	none	1 to 5	.....	0.5 max

THE OPERATING ENGINEER

George Edwards
Advisory Editor

PRACTICAL AIDS • MAINTENANCE HINTS • QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Take a Good Look at Secondhand Turbines

If you plan to buy a used machine, play safe by having it inspected by an expert and get manufacturer's data, advises district engineer George Gregg of Westinghouse

EVEN IF YOU HAVE A HIGH PRIORITY rating it takes a long time to get a new turbine delivered, and there is little prospect of improvement in the near future. Many plants already operate used turbines and soon many more will search through the rapidly dwindling supply of usable machines.

Before buying either a new or a used turbine generator (or boiler) having a value over $1000, the prospective purchaser must obtain official permission from the Director of Industry Operations of the War Production Board. This paper amounts to the same thing as a priority and you can't get one without pretty good reasons.

Armed with the WPB blessing, the power-short engineer may start culling over the secondhand crop either on his own or through used-equipment dealers. In either case, engaging the assistance of an experienced turbine engineer from the manufacturer to investigate the condition of the machine is money well spent as insurance against buying an unsuitable unit. Turbine manufacturers can usually supply the services of an engineer-inspector at a flat day rate plus living and traveling expenses.

It generally pays also to send along someone to represent the purchaser, preferably the man who must later operate the machine. There is no substitute for first-hand intimate knowledge of used equipment.

It is impractical to expect a manufacturer's service engineer to determine the exact extent of repairs or to guarantee operating performance after an ordinary field inspection. However, a

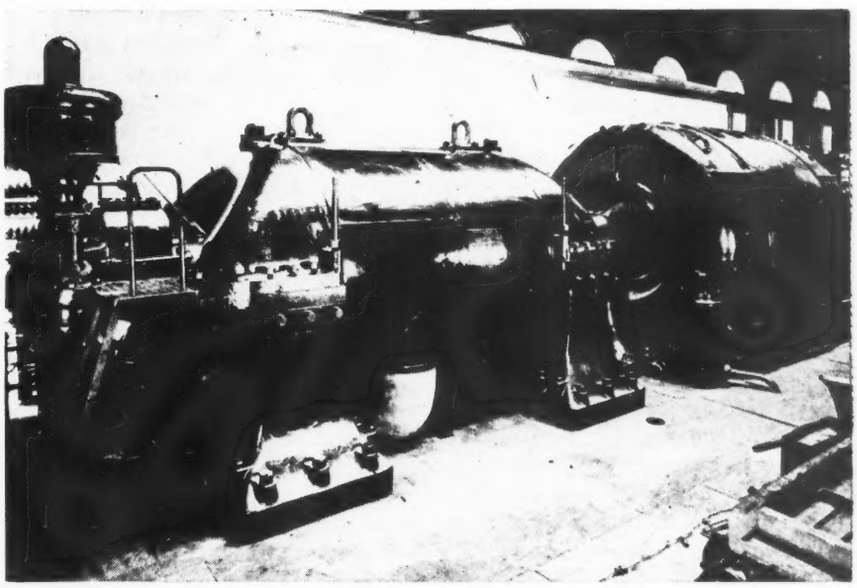


Fig. 1—In the manufacturer's files are records of this old faithful. It and many others like it will hold out for the duration if repaired and well cared for

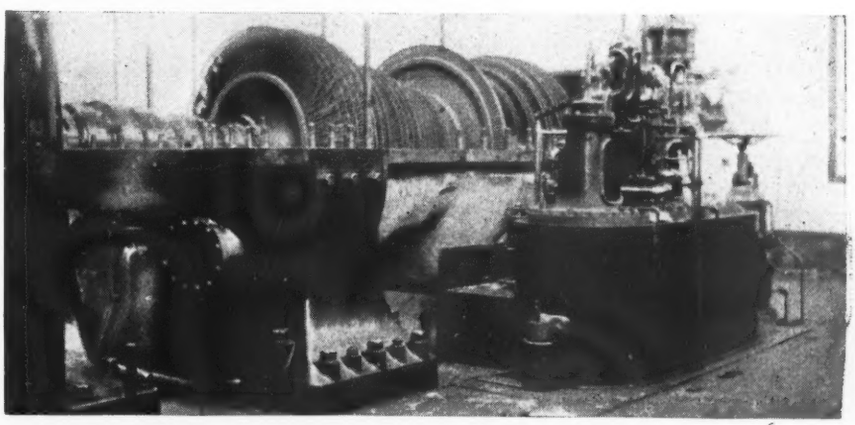


Fig. 2—Lift the turbine cover before closing the deal so that an expert can check governor, bearings, blades and sealing glands with critical eye

Fig. 3—This stator is due for an overhauling in an electric repair shop before starting life over again in a new strategic location

rough preliminary report of the probable cash outlay and a general size-up of machine condition may have an important influence on the choice between two otherwise suitable machines.

The cover of the turbine should be lifted and the end bells of the generator removed. Feeler gages and other precision measuring instruments tell if clearances are close to original design values. As a minimum precaution, megger test the condition of all electrical circuits of the generator and exciter.

These Are Musts

The engineer also checks (1) governors, both constant-speed and overspeed, (2) bearings, (3) glands, (4) blades, (5) shaft at gland zones and bearings, (6) sealing stages between stages and dummies, (7) coupling, and, (8) general wear by erosion and corrosion. After meggering field and armature windings of both generator and exciter, the condition of bearings, exciter commutator and collector rings is noted.

Where possible, a more complete inspection includes removal of the spindle so that the cylinder base can be examined. This is especially desirable for units that have nozzle blocks and stationary impulse blades in the cylinder base only. As to the generator, the rotor should be removed for inspection of both stator and rotor to determine possible distortion of coils, condition of insulation and injury to laminations.

As part of his service, the manufacturer's engineer should include in his report an outline drawing giving space requirements, original contract guarantees and original steam conditions for which the turbine was designed. This information is essential to determine the suitability of the machine to new plant conditions. Although new-unit performance cannot be expected, original steam rates will help in planning the over-all plant extension.

Expected Performance

If operating conditions differ from design values, the manufacturer should be consulted for estimates of expected performance under the changed pressure and temperature or vacuum. There may be changes necessary to adapt the machine to new conditions, in which case the manufacturer will indicate what has to be done and the cost.

If new parts are required or new work has to be done by the manufacturer, the purchaser must be sure his "priority" entitles him to obtain the necessary new materials. In particular, tin and babbitt for bearings, chrome steels, copper and nickel are critical materials requiring specific authority for their use.

Sooner or later a cost estimate will be needed. This will include not only the first cost of the generating unit from owner or dealer but several other incidental expenses. Among these items are costs of (1) dismantling and crating, (2) transportation to your plant, (3) repairs and parts, (4) new foundations, (5) wiring and switching equipment, (6) piping, (7) labor, supervision and incidental expense for installation. Add at least 10% for contingencies.

Under present conditions, economic factors are less important than time. A secondhand turbine in operation next winter may outweigh a new turbine on paper. On the other hand, buyers can hardly expect new-turbine performance from even the best of used machines. Maintenance costs will inevitably be higher. Outages will be more frequent and for longer periods. Careful inspection of used equipment and effective repairs before purchase will help keep such maintenance and outages within reasonable bounds.

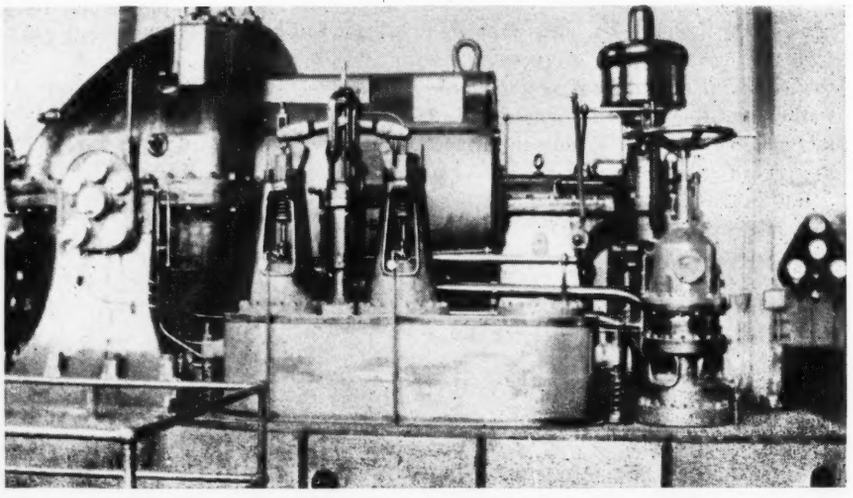


Fig. 4—A typical used machine turning out power for its new owner. Maintenance may cost more than for a new machine but the kilowatts are of equally good quality

NEW BOILER AND TURBINE
for St Mary's Hospital

Chief Engineer John H Herzog reviews plant growth from 1910. Latest additions are 2100-sq-ft boiler, 50-kw turbine and 15-ton ice machine. Turbine serves fluctuating laundry load, reducing maximum demand on purchased current by 35 kw.

OLDEST CATHOLIC hospital in California, St Mary's, was first operated in 1857 by the Sisters of Mercy, with 27 patients. Today the main hospital building can serve 400 patients. Other departments include a large outpatients clinic, a college of nursing with modern class rooms and 150 private rooms for student nurses, an internes' home and several other buildings spread over three city blocks.

The Original Plant

When started in 1910 the power plant included two 2500-sq-ft Franklin watertube boilers, two 75-kw dc General Electric generators driven by Brownell slide-valve engines, one 35-kw G E motor-generator, one 15-kw G E balancer, the necessary steam-driven pumps for feedwater, fuel, vacuum and water, and a 5-ton ammonia compressor.

In 1926 another patients' wing, a new surgery, X-ray, laboratory, kitchen, cafeteria and laundry were added. These more than doubled the steam demand. Starting at this time, all new electric equipment was purchased for ac current, and 75% of the electric load was contracted from the public utility. The generating sets were thereafter used mainly for standby services and for the remaining dc motors. The installation of larger boilers and new ac generating equipment was deferred to some future time.

New Boiler and Turbine

In 1940 a new Nurses' College added another 8000 sq ft of radiation to the 75,000 sq ft of heating load. At this time we ordered a new boiler, a generating unit and an ice machine. After much delay in installation, the new equipment is now in operation.

The new boiler is a B & W, 3-drum, H-type Stirling with 2100 sq ft of heat-

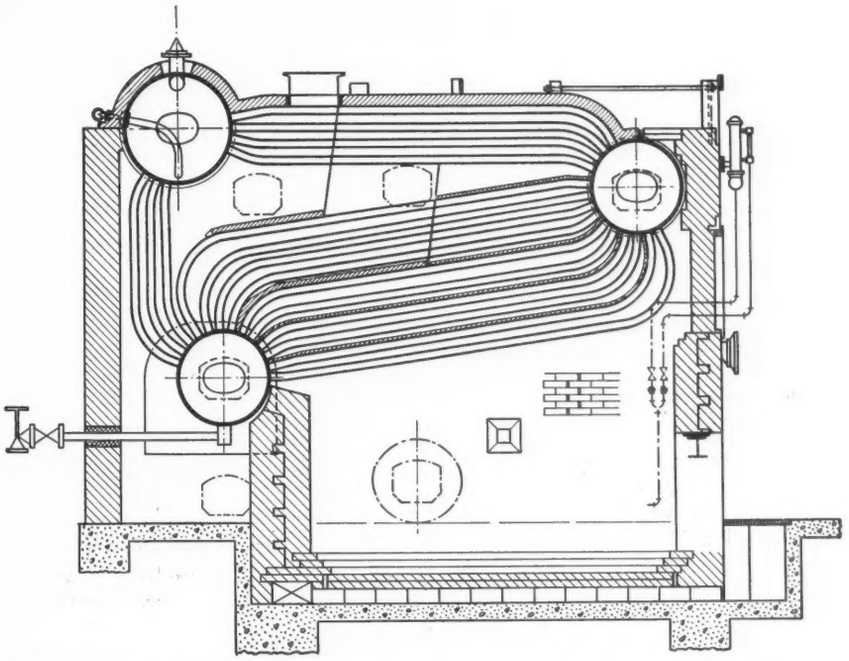


Fig. 1—New 2100-sq-ft, 200-psi boiler fired by oil and gas in combination burners fitted with combustion control which keeps CO_2 above 15% with oil fuel

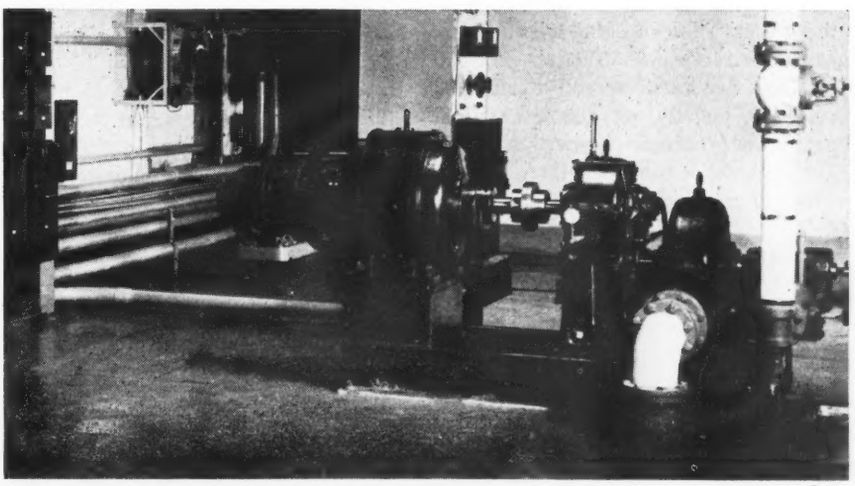
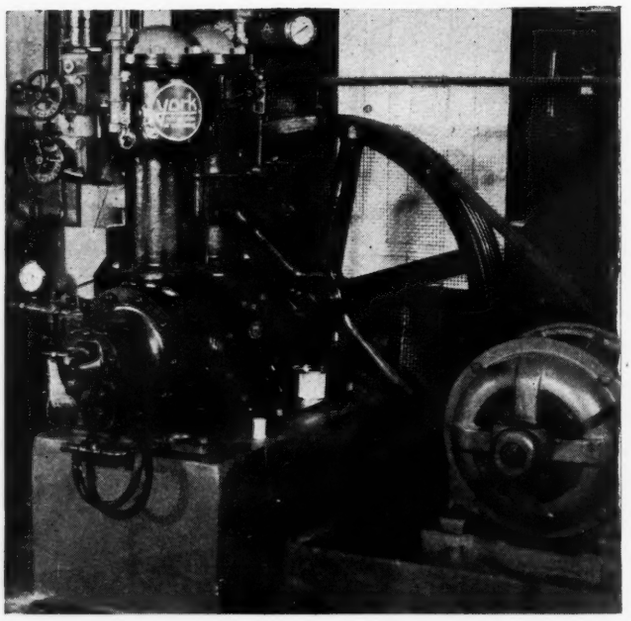


Fig. 2—50-kw generator is gear driven by turbine taking steam at 150 psi and exhausting to heating system. This unit supplies fluctuating load of laundry



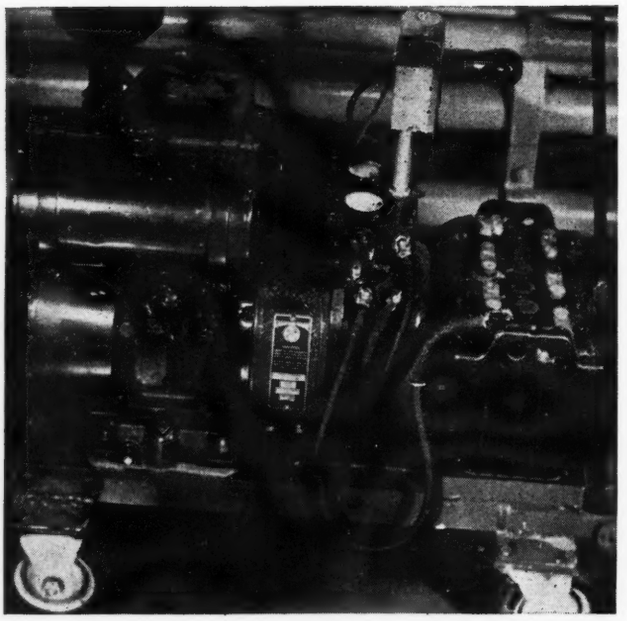


Fig. 3—A 15-ton York motor-driven ammonia compressor extends refrigeration system. Fig. 4—Emergency gasoline-engine-driven generating unit, (1000 watts) can be wheeled anywhere and connected to any circuit in the hospital

ing surface. Design pressure is 200 psi. Associated equipment includes two 3-in. Crosby safety valves, 5-in. Crane non-return stop valve, B & W No 9 gate and angle blowoff valve, Reliance water column with high- and low-water alarm, Ashcroft steam gage, Copes feedwater regulator.

The Leahy combination gas and oil burners are operated through Leahy "hydro-electric" combustion control which guarantees a minimum of 11% CO_2 when burning gas, and 13% when burning oil, at 70 to 150% boiler rating. The firing floor, set 2 ft below the boiler-room floor, is air cooled. A 15% fuel saving over the old boilers has been recorded.

Turbine Serves Laundry

The 50-kw ac Elliott turbine-generator takes steam at 150 psi and exhausts to the heating system at atmospheric pressure. Gears reduce 3600 turbine rpm to 1800 generator speed. Exciter is mounted directly on the generating shaft. The generator is wired for 208-120 volts and is connected through four wires to a switchboard with a 4-pole switch, G E voltage regulator, field rheostat, ammeter, voltmeter and steam gage.

The unit is for standby emergency service whenever the utility power fails, but any part of the building's 208-volt or 120-volt equipment can be operated from this set.

To keep this emergency set in good condition and ready for use, it is operated ten hours per day and carries the laundry power load which is disconnected from the utility lines. This arrangement has proven extremely satisfactory, because the large extractors and reversing motors used in the laundry have a high starting torque, which in turn creates a high maximum power demand.

Maximum Demand Reduced

Maximum demand has been reduced by 35 kw, which means a saving of 6% in power bills in addition to the saving in kilowatt-hours purchased.

In using the exhaust from the turbine for building and hot-water heating a 4% saving in fuel has been recorded. I credit this partly to the steadier boiler load and in part to the superior heating qualities of the saturated turbine exhaust as compared with the superheated low-pressure steam obtained by throttling from 650 psi. All things considered, the turbine-generator will earn its cost within three years.

A word about power charges and the 4-wire network may be of interest. Under our utility rate schedule the consumer is billed for combined power and light from the readings of a single kilowatt-hour meter and a maximum-demand meter. The demand meter indicates the average kilowatt delivery at 15-minute intervals.

Monthly power bill for 47,520 kwhr with a maximum demand of 132 kw would cost $566.44. If the maximum demand were reduced to 100 kw the same 47,520 kwhr would cost only $531.04, a saving of $35.40. Ten years back, under a different rate schedule and with four kilowatt-hour meters, 56,674 kwhr cost $724.30. Today, with the 4-wire network and a single kwhr meter, the same 56,674 kwhr would cost only $605.88—a saving of $118.42.

The hospital plant also includes a portable gasoline-driven 1000-watt ac generator that can be connected to any lighting circuit in the hospital, and can be wheeled anywhere should an extreme emergency arise.

Plant is a Practical Compromise

Since a hospital must have two sources of power, I believe that an arrangement such as ours is practical and economical—a happy compromise between purchased power on the one hand and private plant without standby on the other. Certainly the saving in standby charges, $1.25 per kilowatt per month, is well worth while.

The present refrigerating plant includes: one 15-ton York motor-driven ammonia-compressor, one 10-in. Hartford motor-driven ammonia-compressor, two brine pumps, one circulating water pump, one ice-water pump, one ice-crusher, and a brine tank holding 4800 lb of ice. The brine is circulated through the various ice boxes in the kitchen and the service rooms throughout the hospital. This centrally located plant takes care of all the refrigerating requirements.

✦ ✦ ✦

R Carney, sales manager, Coleman Stove Co, takes a wooden match, lights it, and lets it burn completely. Then he says, "Gentlemen, this is one Btu"—*Firebox.*

Speaking of SLOPPY PLANTS

John M Gorrie answers the consulting engineer who took a rap at "sloppy operation" (POWER, April, page 85)

I HOPE my barging in on this question will be looked upon as merely my findings, as I've mebbe been in more power plants in different parts of the world than the consulting engineer who doesn't approve of many operating engineers. What I write may hurt feelings, but some will get a good laugh. And so to begin:

Many office buildings still use old high-pressure boilers for heating. These boilers are seldom cleaned out correctly. They are used as incinerators. In time they become a mass of rust,

. . . . surveyed by an efficiency expert

and are condemned, which raises a helluva hullabaloo. You will see a lot of dust in those plants. Why? To "save money." They figure it's cheaper to hire one man to fire two or three buildings. Anyway the boiler room pays no rent.

Here's a Sample!

Next comes the average small power plant designed by some engineer "in the dear dead ways of long ago." The ventilation can't be found. Windows (if any) are coated with grime. The little engine-generating set is pounding its guts out, and the feed pumps whinny like the old gray mare. The boilers shrivel and buckle when fired up for the afternoon load — all because no money has been put out for repairs.

Too Good for the Job

The engineer in such a plant is generally of the old school—a fellow who yelps about being an "engineer and not a machinist" and is generally paid for his trouble in chocolate drops. In many cases he is hired to "do the fixing" and the real boss is an iron moulder, pattern-maker, or a grocer with an idea that anybody can run a power plant. The executives let such duds hire the engineer.

Office Boss

Too many power plants are operated from the office. The engineer can't buy what he needs. The office does his buying—even chooses his boiler compound for him.

In one plant the engineer was bawled out for taking a boiler off the line, after he had discovered that the blowoff valve casing was cracked and the blowoff piping badly corroded. Later in the day he was fired when they found they had to buy a length of extra-heavy pipe with steel fittings.

Savings Not Wanted

Another plant hired an engineer "to see what you can do." He went ahead, then he stopped. This was in a refinery, which could have used every pound of exhaust steam. This plant had two nice little engine-driven generating sets sitting idle. The engineer turned the steam on one engine and found it okay. The next wasn't, so being a bright youth, he commenced to take it adrift. That's where he made his mistake, for it turned out that the public utility had sold the boss on the idea of purchasing power. The engineer quit, and I don't blame him.

"Genius at Work"

In another run-down plant, the engineer was an up-and-coming youth who also did his best, but it wasn't enough. They brought in a consulting engineer who had the plant surveyed by an "efficiency expert"—and what a farce that was! One day he came into the engine house and sat down on a box. In one hand he held a watch, and in the other an indicator to count the drips of water from a leaking faucet. When this "expert" was questioned, he high-hatted the engineer. Further questioning brought a snooty explanation about the cost of city water and the drops equalling so many gallons.

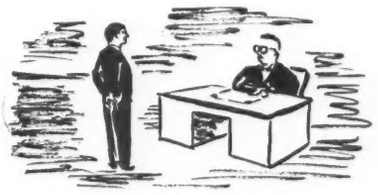
The engineer explained to this snooty drip that the water leaking from the faucet came from an overhead tank, which contained water not fit for drinking and not for the boilers (too hard). He explained also that this water was pumped from a well by air lift and cost approximately 1/3 of a cent per 1,000 gallons. The expert left and never returned. Nothing happened, but he and the consulting engineer were well paid for their "trouble." The humble engineer got his usual in the pay envelope.

Then there was the dope with an engineer's license, who took a job too big for him, after he had got the real engineer fired. I admit there are many of such. They are the ones who are chasing most of the power-plant owners into the arms of the public-utility companies.

Stupidity and Hot Air

One cause of sloppiness is the general ignorance of the office staff about what goes on in a power plant. Then there are those men who call themselves engineers and cut each others throats to impress somebody.

And there's the stupidity of plant managers who have prospective engineers interviewed by some numbskull



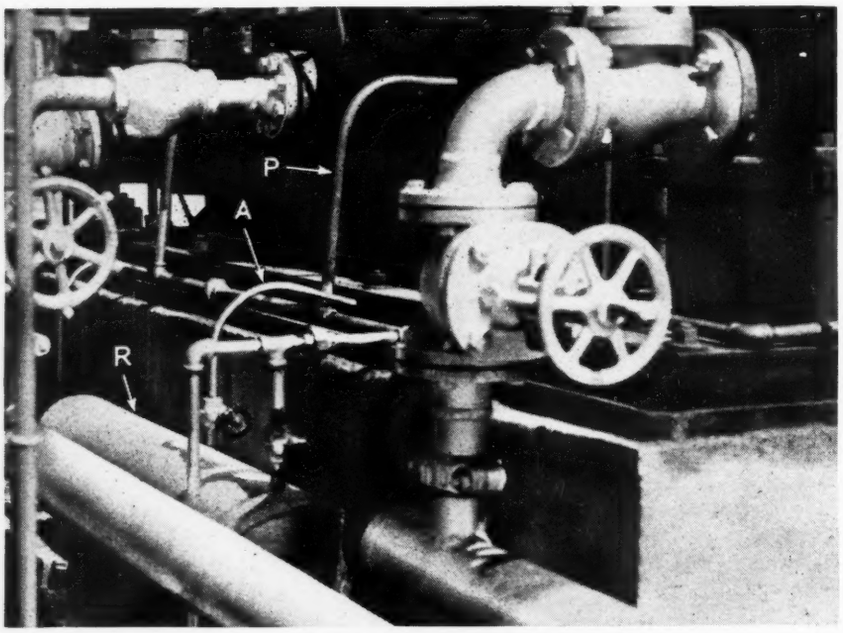
. . . interviewed by some numbskull

who doesn't know his neck from his elbow about a power plant or anything mechanical. They're still doing it.

The "ham and eggers" are everywhere. While the real engineer hates like the dickens to spout too much, the half-wit bull tosser strays in and "sells himself" into a soft job.

Don't put all the blame on the engineer; it isn't always his fault. Spread blame all the way down the line from the president of the corporation to the coal passer. And don't forget to include the consulting engineer.

PRACTICAL AIDS TO OPERATION



Receiver Saves Drips From Centrifugals

DRIPS FROM THE PACKING of centrifugal pumps handling process liquids can be saved by the simple expedient used in one plant and shown in the photo. Liquid leaking through the packing is led through pipes *P* into a receiver *R*. This receiver, made from a convenient length of pipe with welded heads, is vented to atmosphere so that the liquid will flow readily into it. A small compressed-air connection *A* to the receiver serves to apply pressure to return the drained liquid either to storage or to the suction tank for the pump.

Santa Monica, Calif. JOHN C ALBRIGHT

Don't Always Blame The Voltage Regulator

MANY THINGS THAT HAPPEN in a power house to cause faulty voltage regulation are usually blamed on the automatic regulator. This is unfortunate, because a voltage regulator is not a cure-all; all it can do is change the resistance in the exciter field circuit in accordance with generator voltage changes. Engineers for a town in Iowa complained of poor voltage regulation and sent the regulator manufacturer voltage charts proving their point.

A service man was sent to investigate. He made a thorough check of the voltage regulator, found it working perfectly. It was finally found that the recording voltmeter was connected to a different phase than the voltage-regulator element. Because of a serious unbalance of the voltage across the different phases, the voltage measured by the voltmeter did not agree with the regulated voltage. The regulator was holding a constant voltage on the regulated phase.

To correct this trouble the regulator and voltmeter were connected on the same phase. The voltage charts were then good and the system superintendent immediately set about correcting the voltage unbalance of the phases, a matter of loading them as nearly alike as possible.

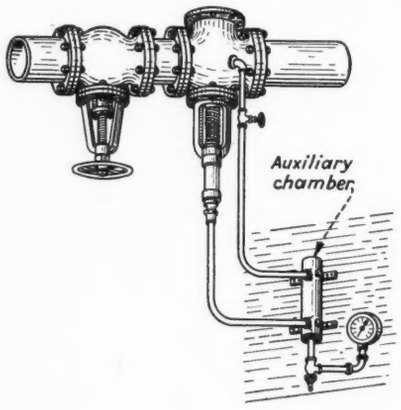
Another complaint was found to be caused by a loose exciter belt. The engineer could not get satisfactory voltage regulation until we suggested that he tighten the exciter belt. He did, and for a short time regulation was satisfactory. Soon the old trouble returned and tightening the belt again corrected the trouble. Stretching and tightening the belts continued to the limit of the adjustment. Then it was realized that the exciter drive did not have sufficient capacity and it was replaced by a larger one that cured the trouble.

Milwaukee, Wis. A M SHONG
Allis-Chalmers Mfg Co

Condensate Chamber Cures Packing Trouble

WE HAD TROUBLE with the cup packing on the piston in the hydraulic operating cylinder of a steam-pressure-reducing valve. This valve was installed with the operating cylinder below it as in the figure, but with the actuating pressure line connected directly from the cylinder to the low-pressure side of the valve.

Sudden and prolonged demands for steam caused a drop in pressure in the low-pressure line that appeared to flash most of the water out of the operating cylinder. This was always accompanied by a temperature rise in the cylinder above that safe for the composition cup packing on the piston in the cylinder, and leaks occurred consistently around this packing.



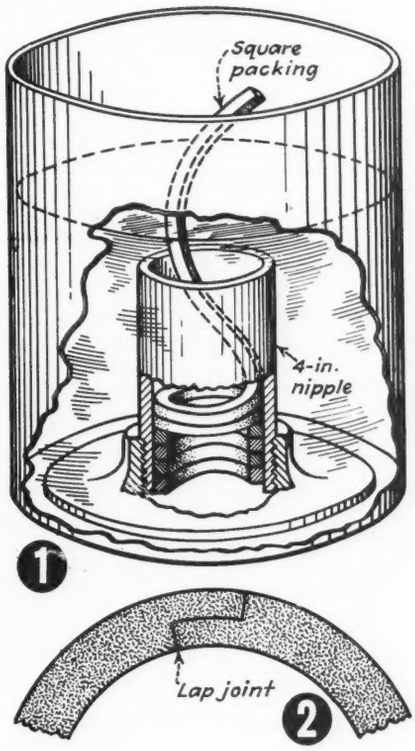
To eliminate these drips and increase the packing life we installed an auxiliary chamber in the actuating pressure line, as shown, made by welding a section of pipe. This chamber has about twice the capacity of the valve-operating cylinder and insures an adequate volume of cool condensate at all times to operate the valve. It has eliminated the sudden temperature changes caused by heavy low-pressure steam demands and has greatly increased the life of the packing.

Prescott, Ore. J A ABENSTALLER

Fitting Packing on a Pump Piston

TO FIT HARD SQUARE PACKING into the piston of reciprocating pumps, and do it right, may be quite a chore. Recently I had to do this job on a 4-in. diameter piston, where it would have been difficult to get a good packing fit. To shape the packing I screwed one end of a 4-in. pipe nipple into a flange and put it in a bucket of hot water. I then put the packing in hot water to soften it, after which I coiled it in the nipple, Fig. 1.

When the packing was properly coiled I removed the nipple with the packing in place and let it cool, to set the packing in the desired shape. To fit the packing on the piston I cut off rings about ¾-in. longer than the circumference of the cylinder liner and then carefully fitted their two ends into a lap joint, as in Fig. 2. These rings make a tight fit in the cylinder and do likewise when put on the piston. I have always found a lap joint like Fig. 2 preferable to a diagonal joint, because once the packing is fitted in the cylinder its ends cannot slide when the rings are put on the piston.



Riverdale, N. Y. ALEX GRAY

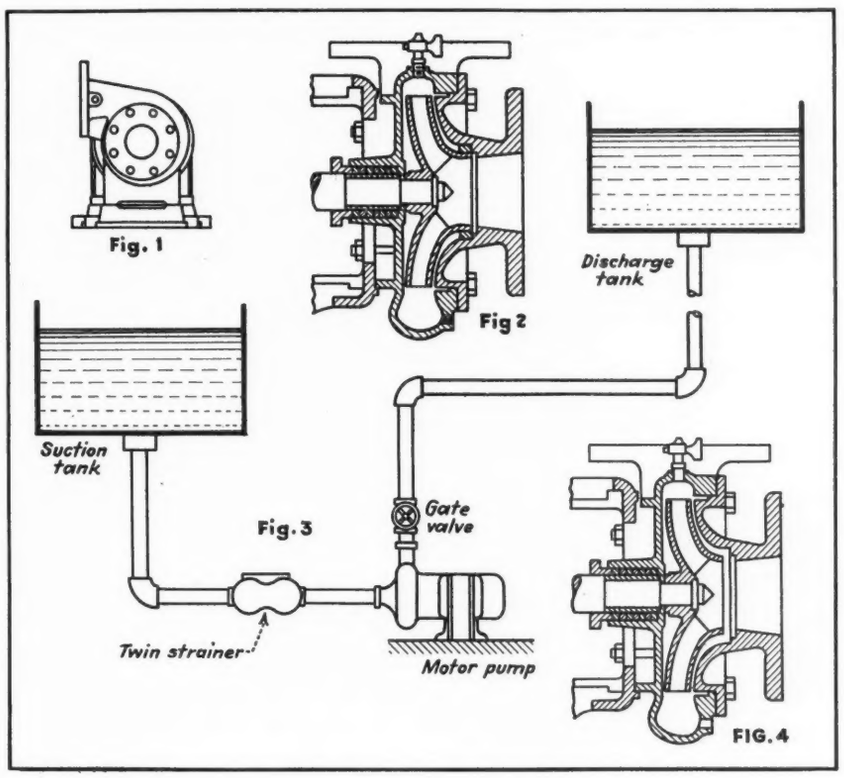
Don't Hang Pipe by Flange Bolts

CERTAIN "DONT'S" APPLYING to pipelines appear almost too simple for an experienced piping man to talk about. Yet, every now and then one finds them violated, such as supporting a pipe from a flange bolt. If these bolts hold the flanges tightly they have served their purpose. The real objection to the practice is that while a pipeline usually has a sufficient number of hangers so that under ordinary circumstances the removal of one would hardly matter, they become vital in case of repairs. When the flange bolts are taken out, the pipeline is left without a hanger at the place where support is most essential.

New York, N. Y. ARTHUR H KORN

Changes in Pump Cure Air Troubles

SOME OF THE MOST DIFFICULT PROBLEMS of centrifugal-pump operation occur when air gets in the suction line. Despite the trouble caused by air getting into the suction line of a centrifugal pump it is sometimes impossible to avoid it; the experience in a textile plant may be of assistance in other cases more or less similar. In this plant they had a small stainless-steel motorpump installed with a horizontal duplex strainer in the suction line going to the pump, as in Fig. 3. This strainer required cleaning every hour although the installation was such that continuous pumping was necessary. The duplex strainer was arranged with a lever so that the suction could be shifted from one chamber to the other without stopping the pump.



When each strainer was cleaned the liquid in it was drained into a sump and the chamber filled with air. When the flow was shifted to this strainer, all the air in it went into the impeller eye, and reduced pump capacity. While the pump could be freed of air by stopping it momentarily, the constant operation and steady flow required by the process made it impossible.

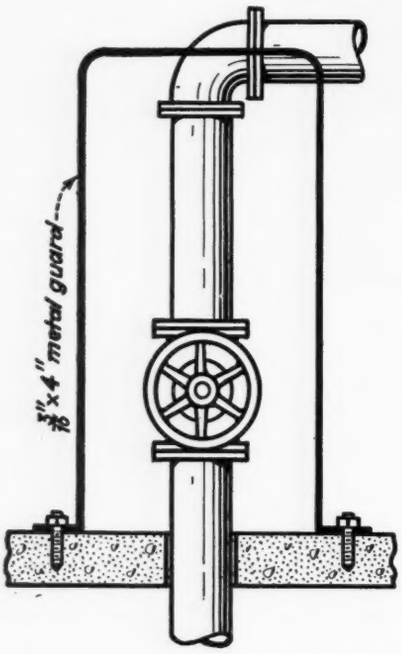
Sometimes it is possible to free a pump of air by arranging its casing for horizontal discharge, Fig. 1, instead of vertical, Fig. 3. This was tried and gave improved pump performance but not as much as desired. As the pump had considerable excess capacity, controlled by a valve in the discharge line, we decided to recirculate some of the discharge back into the suction to help remove the air, in much the same way as done in some self-priming pumps.

To do this we removed the casing

ring around the eye of the impeller, Fig. 2, and cut the impeller hub back to about the width of the casing ring, as in Fig. 4. The pump then operated satisfactorily, ridding itself of air from the strainer without any reduction in discharge rate.

There are other more simple ways of correcting this trouble under normal conditions, but anything we did had to be done without adding any material. All parts had to be stainless steel and they could not be obtained. While a centrifugal pump is normally not recommended where air will get into the suction, this experience indicated that it is possible to handle such conditions if the pump is arranged for top horizontal discharge, end suction with an open impeller.

New York, N. Y. FRANK A KRISTAL

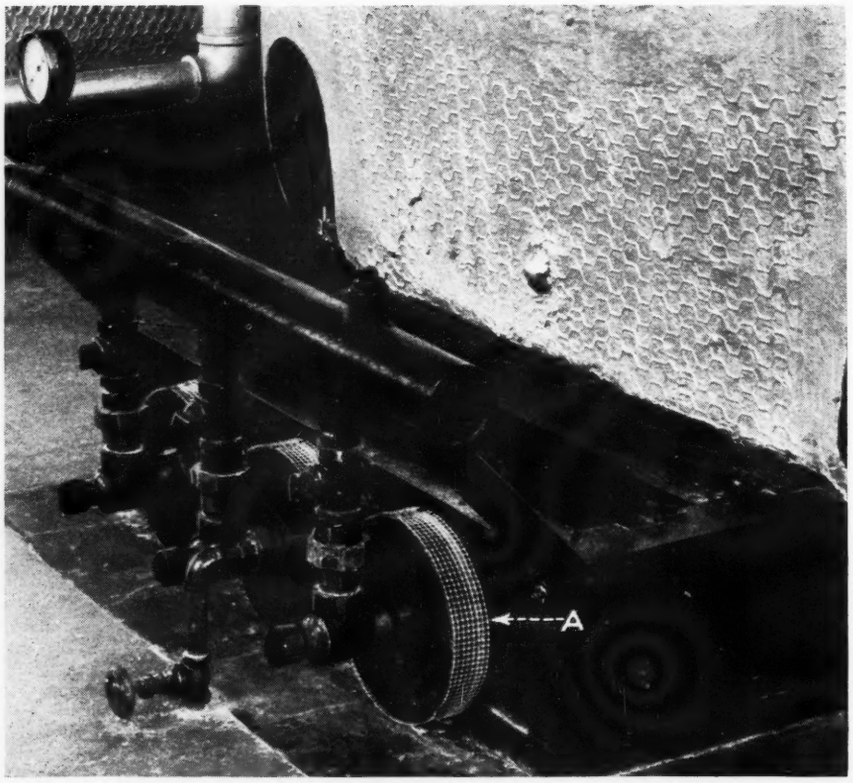


Safety Guards for Low Valves

IF PUMPS OR OTHER MACHINES placed on low foundations are served by pipe lines rising from trenches below the floor level, it is quite frequently necessary to install the valves in these lines horizontally. When this piping layout must be employed, the projecting trimming and stems of the valves, being very close to the floor, constitute a dangerous hazard. Numerous severe accidents have been caused by such installations. In one instance the operator stumbled over a low valve and suffered injuries that nearly proved fatal.

To prevent further accidents, guards were installed around all valves over which a person might stumble. Many of these guards consisted of short pipe railing sections placed on either side of the valve with space for valve operation. In other cases, especially where valves were small and of the non-rising-stem type, U-shaped guards made of ⅜x4-in. strap iron, similar to those shown in drawing were provided.

Atlanta, Ga. H P CLEARY



Screens Keep Bugs Away From Burners

OUT WHERE THE NIGHT-FLYING BUGS are large and numerous they may seriously interfere with the operation of gas-fired boilers, as in the installation shown in the photo. This and two other boilers were each equipped with burners that had circular air controls. At night the light from the burners attracted large numbers of bugs that accumulated on the controls, frequently filled the air passages and caused poor combustion. To overcome this difficulty the fireman screened the air intakes to the burners, as shown at *A*. These screens were attached to the stationary part of the burners and slightly cleared the rim of the air-control disks. Now if the bugs lodge on the screen they can be swept off.

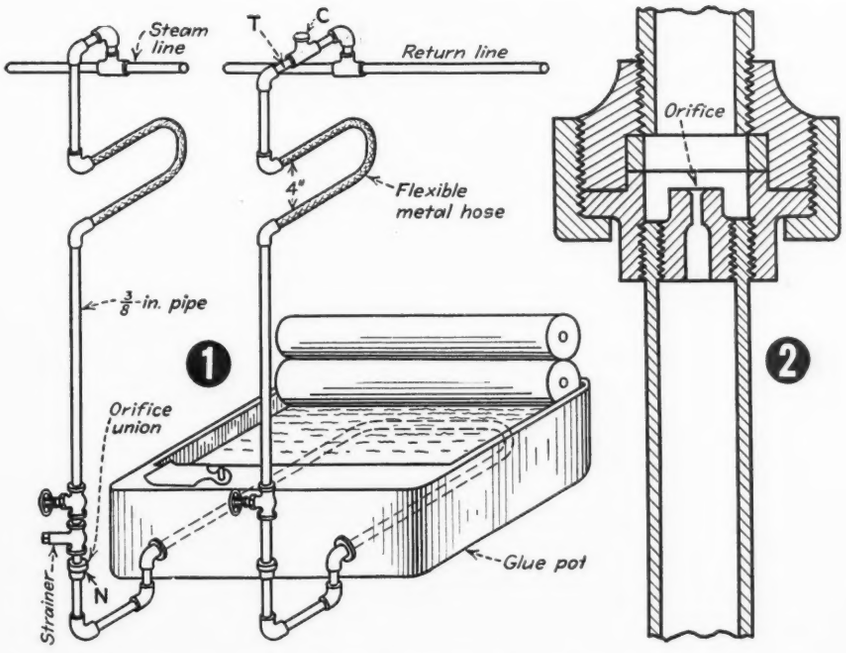
Santa Monica, Calif. J C ALBRIGHT

Electric Welding Repairs Broken Crankshaft

IT WAS MY MISFORTUNE to have the crankshaft break on an English vertical compound steam engine. To get a new shaft was out of the question so I decided to weld the broken one. Several engineers with whom I discussed the problem said the shaft could not be repaired. However, I had everything to gain by a trial, therefore proceeded to do the job. It is a valuable asset sometimes not to know that a job cannot be done.

I realized that the most difficult part of the problem was to hold the two parts of the shaft in correct relation to each other during welding and cooling. A 12-in. I-beam and a bar of ¾ x 4-in. steel was obtained to make a welding support for the shaft. We cut the bar in lengths about equal to the width of the I-beam face, and welded them along its top to support the shaft properly at its journals, as in the figure.

We next put the I-beam on a planer and cut notches in the bars to the radius of the bearing journals. After this operation we put the shaft in place, lined it up and held it firmly in place, using clamps made of ¾-in. bolts and



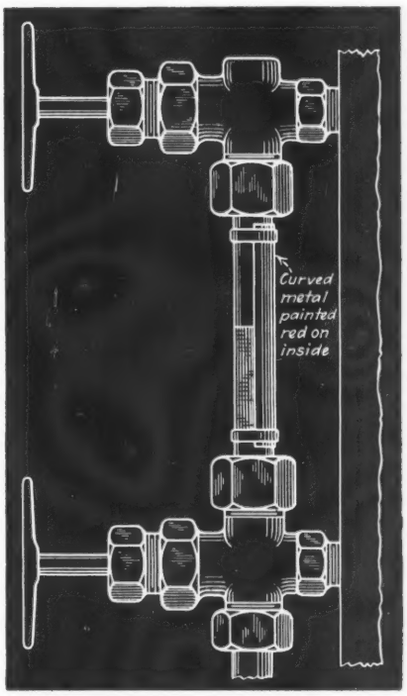
Orifice Solves Difficult Heating Problem

OUR GLUE POTS are water jacketed and heated from an overhead 25-lb steam line, the general arrangement being shown in Fig. 1. Orginally, condensate was trapped from the jacket-water heating coil by a trap installed at *T*, but this did not work satisfactorily. Sometimes the glue temperature became so high that the glue boiled over and at other times the temperature was too low. In fact the glue pots were a headache, so much so that something had to be done.

After studying the problem I decided that the traps could be eliminated by installing an orifice in the steam line to each pot. I made the orifices from pipe plugs threaded into the 3/8-in. pipe nipple in the union at *N*. A cross-section of the union and orifice is shown in Fig. 2. The orifice is approximately 3/32 in. in diameter, but the exact size must be determined by experiment. I started with an orifice that I knew was too small and gave it a trial to see what temperature I got in the glue pot. Then I enlarged the orifice a small amount and made another trial run. I kept repeating this process until I got a size that would pass sufficient steam to maintain the water at 160 F, which on this installation proved to be about a 3/32-in. Now the only control device in the line, except the orifice, is a check valve at *C*, Fig. 1.

Since making this change the glue pots operate without the least attention and remain on the steam line all the time unless a machine is taken out of service. At night after the plant shuts down the engineer closes the valve on the steam line supplying all the pots. The next morning this valve is opened in time to have the glue at the correct temperature when the machines are started.

Englewood, N. J. R BOETTINGER



Silhouette Liquid Level For Better Visibilitv

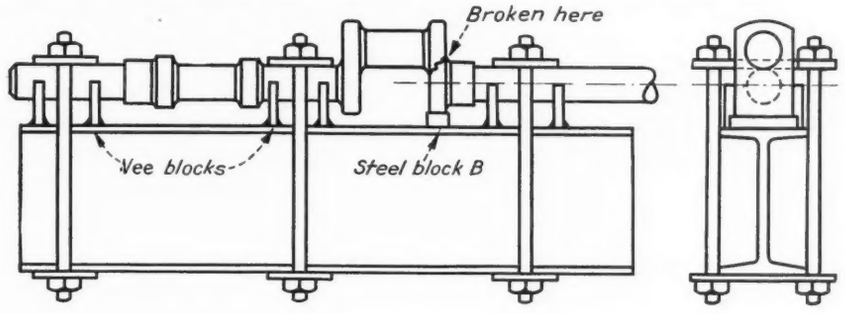
HOW TO SILHOUETTE the liquid level in a gage glass so that it can be easily read at a distance is a problem that frequently confronts operating engineers. Recently I did some experimenting with methods of doing this and developed an idea that merits attention because it is simple and effective. The device consists of a piece of sheet metal curved to approximate the gage-glass surface, painted a light red on its surface. When this is held back of the gage glass, as in the diagram, the liquid in the glass will be a much darker red than the original paint and the empty section of the glass will be lighter in color. This color difference makes the liquid level stand out clearly, and it may be distinguished 40 or 50 ft away.

New York, N. Y. P E MEREDITH

pieces of steel plate. We fitted a steel block *B* snugly under the broken web of the crank to relieve the strain caused by the heat of welding and to bring the fracture to its original position.

To do the welding we first cut a vee one-half way through the fracture, stopping at intervals to let the metal cool. After the vee was welded full we repeated the operation on the other side of the web. Welding was done with an electric arc and rods containing 3.5% nickel and 2% chromium. When welding was completed and the shaft cooled it was put into a lathe and found to be only 1/64 in. out of true. A jack to spring the shaft in the right direction and a blow with a sledge hammer corrected this slight misalignment and we were able to put the engine back in service without further trouble.

Goodrich, Ont. GEORGE BARRETT



How to Figure Beams—No. 2

By PHIL SWAIN

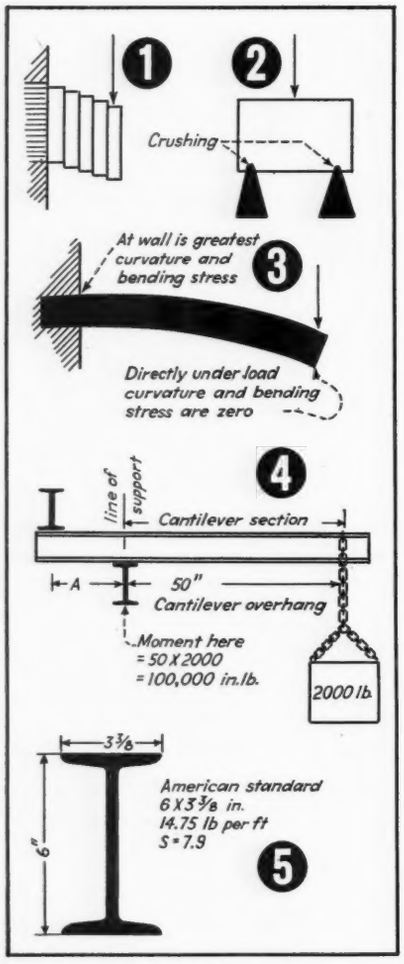


Fig 1—Failure by shear (here shown diagrammatically) will never occur except in extremely "stubby" beams

Fig 2—Failure by crushing at the supports occurs only when beam is extremely stubby or when supporting areas are extremely small

Fig 3—In a "cantilever" (overhanging) beam with a concentrated load the bending moment is greatest at the support (wall in this case) and zero at the load

Fig 4—In this cantilever the greatest bending moment is 100,000 inch-pounds at the support

Fig 5—With a maximum safe unit stress of 18,000 psi, this I-beam section would be good for a bending moment of 7.9 x 18,000 = 142,200 inch-pounds

IN the great majority of cases beams fail by bending, if at all, so this article, and those that follow, will deal almost exclusively with bending strength. Yet users of beams must remember that under certain extreme conditions a beam may fail by shearing off or by crushing at the supports.

Any moderately long and limber beam, reasonably well supported, will fail by bending long before the shearing or crushing action becomes important. The other extreme is an extremely stubby beam—one that is extremely short considering its depth and section. The load required to break such a beam by bending will be proportionately high. Before that load is reached the beam may fail by shearing, as shown in Fig 1, or by crushing at the supports, as shown in Fig 2. The latter type of failure, of course, depends on the contact area of the supports as well as on the loading.

Failure by Bending

A later article will show how to tell when there is danger of failure by shear or crushing. Meanwhile we shall figure beams on the basis of failure exclusively by bending.

As explained on page 117 of July POWER, bending stretches the material in the convex side of a beam and compresses that in the concave side. The beam naturally fails at the section where the bending moment is greatest, and the failure there will start in the extreme top or bottom fibres.

Perhaps the easiest kind to figure is the "cantilever" or overhanging beam, Fig 3, with a concentrated load at the end. Such a beam always breaks at the support. This is natural because the bending moment at any section is equal to the load on the end of the beam multiplied by the distance or lever arm from that load to the section concerned. The bending moment is greatest at the wall, being equal to the load times the length of the beam from the wall to the load.

In Fig 4 the overhanging part of the beam is a true cantilever. Here the lower cross-beam support corresponds to the wall in Fig 3 and the bending moment at that point is 50 x 2000 = 100,000 inch-pounds. This moment is entirely unaffected by the distance A between the two supporting beams. If A were reduced by moving the upper beam to the right, that would not increase the bending moment at the point of support. However, it would greatly increase the upward force on the upper beam and the downward force on the lower.

That means that distance A must be enough to prevent damage to these supports or crushing at the contact points. If A is large enough to prevent this it is only necessary to consider the maximum bending moment of 100,000 inch-pounds.

This external moment will be exactly balanced by a 100,000-inch-pound moment produced within the section by the stressing of the metal, according to the following formula:

Unit stress in metal × *Section Modulus* = *Moment.*

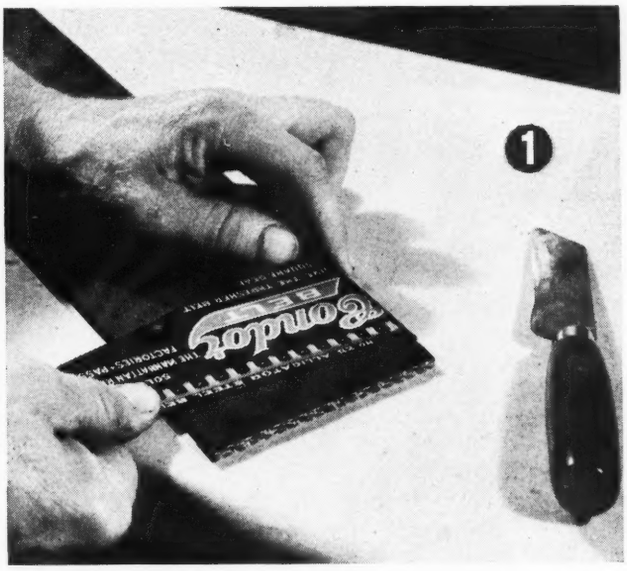
As explained last month, the "section modulus" S is a number expressing the strength of the *cross-sectional shape* of a beam as distinguished from the strength of the *material* of the beam. In other words, if you multiply the "*stress in the material*" by the "*strength of the shape*" you get the "moment," or the ability of this shape at this stress to resist an outside bending moment, or bending effect.

I-Beam on Safe Side

Suppose the beam shown in Fig 4 is that of Fig 5 having a section modulus (or "shape strength" S) of 7.9. According to most building codes, rolled steel sections may be used safely at unit stresses of 18,000 psi. That means that this section could safely withstand a bending moment of 18,000 × 7.9 = 142,200 inch pounds, whereas the actual bending moment is 100,000 inch pounds. Obviously this beam is very much on the safe side; a smaller beam would do the job.

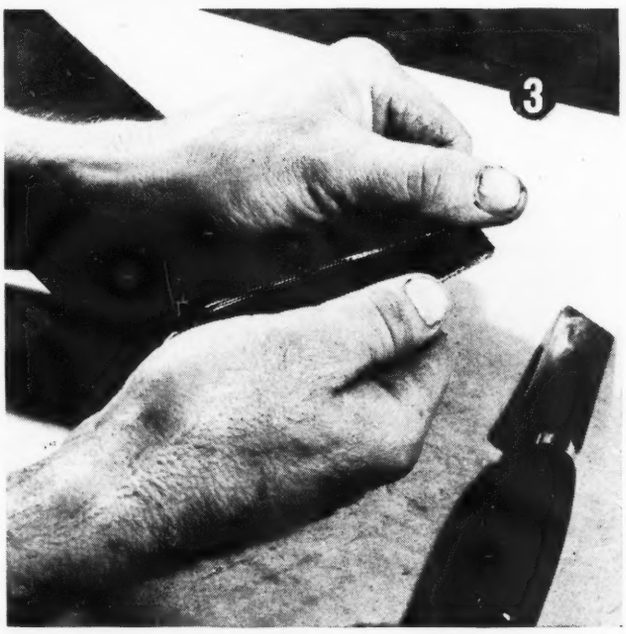
Next month I shall give other examples of beam checking and beam selection.

HOW TO CUT FLAT BELTS SQUARE



ONE of the most important elements in joining the ends of flat belts is to make sure that these ends are cut square. Unless this is done all other operations, no matter how carefully completed, cannot produce a good job. If the ends are not cut square, after they are joined the belt will run crooked and may run off the pulleys. The fasteners will put uneven stresses across the belt width, which will cause the fasteners to fail prematurely and may cause tearing of the belt. When the ends of a belt are not cut true some of the fastener connections come too close to the cut ends, thus increasing possibility of pulling out. *Photographs taken with the co-operation of Manhattan Rubber Mfg Div, Raybestos-Manhattan.*

1—To cut the belt, place a carpenter's square or a belt square on it. The latter can be obtained from a belting company. If you have any doubts about the side of the belt being straight, as on a folded-edge belt, place the square against one side and mark across the belt. Then place the square against the other side and see if it squares with the line. Do not remove the square and try to cut the belt in one cut along the pencil line; a crooked cut will always result because it is impossible to guide the knife



2—Place the end of the belt on a soft-wood board or preferably a piece of flat conveyor belt with its rubber covered side up to prevent the belt from slipping during the cutting operation. Then with the square held firmly in place for a guide and using a sharp belt knife make a cut with the knife point through one or two plies

3—Make the first cut as shown. Repeat the cutting operation until the belt has been cut through. While cutting be sure to hold the knife vertical to the length of the belt to make a square cut down through the belt

READERS' PROBLEMS

Questions from Our Readers

What Makes Meter Swing?

Question 1

WE HAVE A 4-CYCLE 5-cylinder 550-hp 225-rpm diesel engine direct connected to a 350-kw ac 2300-volt generator. Some five years ago the crankshaft broke and a new one was installed. I am informed that the new crankshaft came with only five counterbalance weights instead of ten as on the original shaft. At this time the firing order was also changed from 1-3-5-2-4 to 1-3-5-4-2.

Since changing the order it has been noted that the wattmeter fluctuates from 100 to 300 kw every few seconds; the power-factor meter also swings from .70 to .90. This swinging or hunting occurs when the engine is on the line either alone or in parallel with other engines. This condition is not noted when the other engines in the plant are on the line alone, with the engine in question off the line entirely, which indicates that the trouble is not related to the plant load.

Efforts have been made to correct the condition but to date they have not been successful. The governor appears to be in good order and no trouble has been found with the voltage regulator on the generator in question.

Would the change in firing order have this effect on the engine or could it be caused by unbalance of the crankshaft, or both? The engine does not appear to run rough or out of balance nor do the fluctuations appear to affect the general running of the engine.—EME

How And When To Pin Piston Rings

Question 2

A question has come up concerning internal-combustion engines about which we would like some advice. Which side of a piston ring is considered the correct one to place pins when they are used to keep the rings from turning? What size rings are customarily pinned? Is this practice recommended?—BAO

Boiler-Feed-Pump Troubles

Answers to June Question 1

The Question

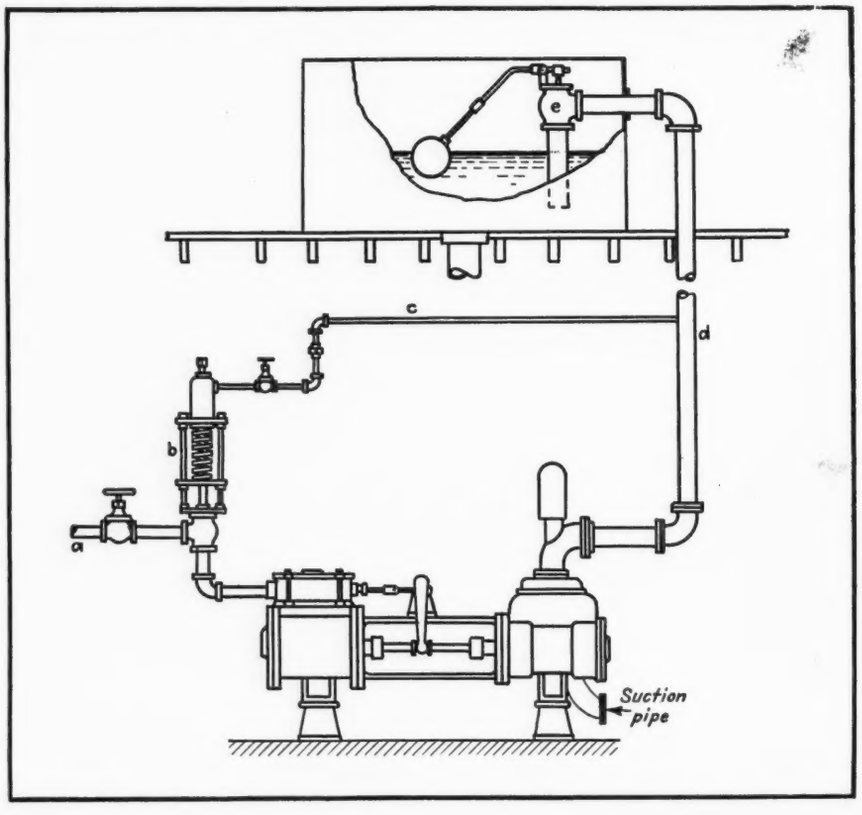
IN OUR BOILER PLANT *we supply feedwater to an open heater from a 20-ft well with a steam-driven reciprocating pump. Water is heated with engine exhaust steam at 5 psi. The cold-water pump is inside the boiler room, about 40 ft from the heater. The steam-driven reciprocating boiler-feed pump beside the heater in the engine room has a positive suction head depending on the height of water in the heater. The boilers are not equipped with water-level control and each pump must be regulated by manual adjustment of its steam supply.*

We have considerable trouble in keeping the pumps regulated to handle the same amount of water. Slowing down the well pump causes it to lose prime. The heater then becomes empty, the feed pump loses prime and becomes steam bound. On the other hand, reducing the speed of the boiler-feed pump allows the heater to become flooded. Can any of POWER'S *readers suggest some means of overcoming this trouble?*—HRT

Requires Pump Governor And Float Valve

A common method of governing a steam pump to maintain a constant water level in an open heater is shown in the sketch. The steam pipe *a* is fitted with a regulating valve *b*, and this is connected by the pipe *c* to the pump discharge pipe *d*. The discharge pipe is fitted in the heater, with a balanced float valve *e* that closes when the heater is full of water. The pressure in the pump discharge pipe is then transmitted through the pipe *c* to the regulating valve which it closes, thus cutting off the supply of steam and stopping the pump. When the water level in the heater is lowered, the float falls with it, thus opening the balanced valve and relieving the pres-

(*Continued on page* 120)



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YARWAY IMPULSE STEAM TRAP

sure on the regulating valve, which is opened immediately by a spring, again starting the pump.

To obtain the best service from steam boilers, the supply of feedwater should be continuous, and the water in the boilers should be maintained at a constant level. With the suggested setup HRT should find it comparatively easy to manipulate the feeding apparatus so that the necessary amount of water constantly enters the boilers.

Hamilton, Ontario S G PATERSON

Reconnect Pump Governor

Most open heaters have a float with a shaft extending through a stuffing box in the heater body and connected to the makeup water supply by means of a lever and connecting rod. If so, HRT can disconnect this rod from the make-up supply and connect it to the pump governor lever through a turnbuckle. If the feedpump is already equipped with a governor designed to limit the pressure in the feedline, this will serve the purpose admirably. All he need do is disconnect the water and steam pipes from the cylinder at the top of the governor and also the counterweight on the governor lever. If his pump is not fitted with such a governor, any double-ported balanced valve, from an old Gardner or Pickering governor, can be adapted. The connection can be made easily if his feedpump is placed directly under the heater. Even if the pump is at some distance away the connection can be made by installing a system of bellcranks and a lay shaft.

Brentwood Bay, B.C. A EASTCOTT

Install Float-Operated Bypass Line

HRT's problem appears to be one of attempting to balance the delivery of two pumps having quite different characteristics. Since the boilers are not equipped with water-level controls, he must continue to depend on manual regulation of the feedwater pump.

It seems that a float might be installed in the heater and connected by levers to regulate the speed of the well pump. Some open heaters are furnished with such float arrangements. It is noted that the well pump cannot be slowed down without losing prime. The float-controlled valve, which might be made up from an old lever-type relief valve, should be placed in the discharge line of this pump, with a bypass connection leading back to the suction line or well. Operation under such conditions would be somewhat inefficient, because of steam waste while water was being bypassed. It is assumed that this connection would not be used enough to be of consequence from that viewpoint.

The fact that the well pump loses prime when slowed down would indicate that a thorough overhauling of the pump and suction-line piping might overcome that difficulty, whereupon the float-controlled valve might be placed in the steam line to this pump. This arrangement would permit more economical use of steam than the first method of regulation mentioned.

Jersey City, N. J. I S CHAMBERLAIN

Make Regulating Valve From Globe Valve

The condition described by HRT reminds me of a similar condition which existed in our plant; perhaps the solution which we worked out may help him to correct his trouble.

The first step necessary is to install a foot valve on the suction line of the pump which supplies cold water to the heater. This will insure the pump maintaining its prime, even though the pump stops or works at extremely slow speed.

A balanced valve should be installed in the well-pump steam line at a convenient point for attaching it to the feedwater heater float. If a balanced valve is not available, a globe valve can be substituted with the steam pressure under the disk. A lever clamped to the stem of this valve and properly connected to the float lever will give sufficiently close regulation for ordinary purposes. The lever on this valve should be clamped to the stem to allow manual setting of the valve for proper pump operation. With the heater full, or when the water in the heater reaches its proper level, close the valve by hand and clamp the lever tightly on the stem.

Redwood Falls, Minn. F B MAES

Liquid-Level Controller For Each Pump

HRT could install a liquid-level controller on his feedwater heater, which will control a valve in the pump steam line. This would maintain a fairly constant liquid level in the feedwater heater, HRT could then have the boiler-feed pump adjusted to operate within the limits of the level maintained.

The liquid-level controller could be arranged to operate the steam valve of the boiler-feed pump, and then regulate the well pump manually within the limits of the liquid-level controller. They might find it advisable to have a liquid-level controller for each pump, so that less personal attention would be required.

New York, N. Y. F A KRISTAL

Put Pump in Good Shape

Two methods can be used to overcome HRT's troubles, if the feedwater is set above the suction of feed pump. This will increase the total head of the supply pump and also the suction head to the feed pump.

To keep the supply pump at a constant speed automatically, he could install a regulating float valve to control the water level in heater, also a bypass and relief valve on the discharge from well pump. This relief valve will open when pressure rises in delivery pipe, due to the closing of regulating valve.

Another simple way of overcoming the trouble would be to install a manually-operated bypass. Both of these methods will keep the pump at constant speed, but will mean a waste in steam consumption during bypass operation.

If the pump is steam driven, suction line and foot valve are in good order, and all pump valves are seating perfectly, there is no reason why it will not operate satisfactorily when a pump governor is used.

Goderich, Ontario GEORGE BARRETT

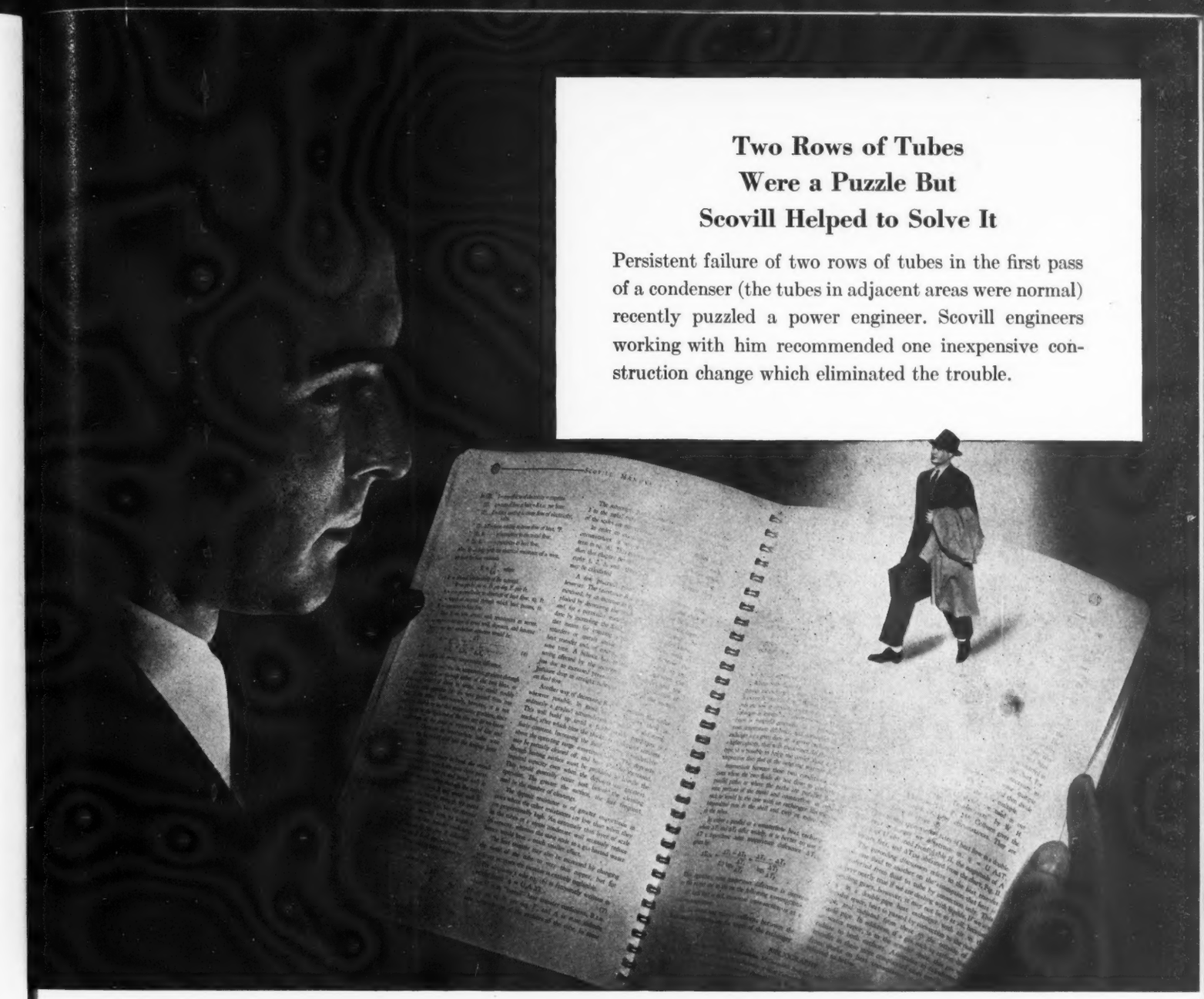
Install Float and Balanced Valve

One answer to HRT's problem is a float-operated regulating valve installed in a bypass from the cold-water supply line to the cold-water well. This may be installed at small expense.

A float of 8-in. diameter with a leverage of 2-3 ft will provide sufficient power to open or close a balanced regulating valve. A bearing 6 in. long should be welded or screwed into the shell of the heater with a packing gland on the outside to prevent leakage. The float drive rod passes through the bearing and is connected to the regulating valve by a linkage which should be attached to the drive arm with a set screw. The float may be adjusted to hold any desired water level in the heater.

The bypass should be located below the cold-water inlet if it is possible. The

(*Continued on page* 122)



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pivot point is attached to the valve bonnet, and the valve may be arranged to move open as the float rises. A shut-off valve is provided ahead of the regulating valve to permit regulator repair without taking the heater out of service.

With this arrangement, when the heater water level rises, the float opens the regulating valve and allows part of the water to flow back to the well. The cold-water pump may be run at constant speed and the feed pump regulated as desired.

San Diego, Calif. C T GEIGER

Install Riser Bypass

Since HRT's coldwell pump must be operated above a certain number of strokes per minute, to keep it from losing prime, I suggest that he keep it in steady operation and install a pipe to spill the excess water back to the coldwell. The simplest way to do this is to install a riser in the overflow line and a float-regulated valve in the heater. To keep water from spilling back to the well when it is needed in the heater, the riser must be high enough to introduce sufficient head to overcome the heater pressure. If this pressure is atmospheric, the height of the riser need be only three of four feet.

If a regulating valve is not available one can be made by turning the threads off the stem of a common globe valve. If heater pans do not interfere, the valve may be installed upside down, with float attached to an extension welded or brazed to the stem. Or, the float rod and valve stem can be connected by means of a lever and suitable pivot, and the valve installed upright. In either case, if the pressure is high, it may be necessary to install the valve with the pressure over the seat, and to use weights to open the valve against pressure. There should be no valve in the overflow line.

Menard, Illinois GEORGE HOLMAN

Install Additional Storage Tank

HRT's problem could be solved by using a pressure control on the cold-water pump, an excess-pressure regulator, and a float-operated valve at the heater inlet on the cold-water line to maintain a constant heater level. A bypass around the steam-regulating valve to the cold-water pump would keep the minimum speed above the point where the pump lost prime. This method would require considerable control equipment which would be difficult to obtain.

The present difficulty with manual operation is lack of cold-water storage. If the rate of cold-water pump operation is below the average rate of boiler operation, a gravity tank above the heater will prevent loss of prime without waste of water or power. If boiler operation is below the minimum cold-water pump operating rate for extended periods, then intermittent operation of the cold-water pump is required to prevent overflow from the new tank. This scheme is shown in the accompanying sketch. The cold-water pump steam-supply line has a valve for manual-speed regulation and a bypass valve for minimum speed setting which can be omitted if main valve can be fitted with an indicator for lowest position. A float valve controls the water level in the heater by regulating the cold-water flow from the new storage tank by using either a direct-connected balanced valve or a pilot-operated valve.

Saint John, N.B. C G CLARK

Float Controls Boiler-Feed Pump

There are many ways to correct the condition about which HRT complains. Most open heaters have floats or provision for one, to control makeup water or overflow, and this can be used to operate a valve in the steam line to the feed pump. If the heater has no float, one can be installed, and if hooked-up as shown the float will cause the feed pump to handle the same amount of water as is being pumped by the well pump. As the latter is located in the boiler room it will be convenient to regulate the boiler water level by regulating the speed of the well pump.

If the well pump and foot valve are in good condition with no leaks in the suction line, trouble should not be experienced from the pump losing its prime when shut down for short periods. HRT should check over these items.

Melrose, Mass. E MACDERMOD

Uses A Pneumatic System

In our plant we use an auxiliary well-water supply for boiler feedwater purposes and we are using a pneumatic system, which keeps the water under pressure, automatically controlled. This water feeds into the open heater through a float valve which maintains an even water level at all times. We find that such a system is also available for other purposes. It enables us to use as much of our own water as we need for domestic service without purchasing water, thus a considerable saving is effected.

Ansonia, Conn. W T ESTLICK

Feedwater Temperature Increased

It seems that HRT's main problem is to maintain the correct amount of water in the feedwater heater. I would suggest that he use a float to control the supply of steam to the well pump. An ordinary globe valve with the threads removed from the stem can be used if no other kind is available. A small hole can be drilled through the valve disk so the pump will continue to operate slowly when the valve is closed. The size of this hole will have to be determined by experiment. It will be necessary to provide an adjustment on the valve control to permit regulation of

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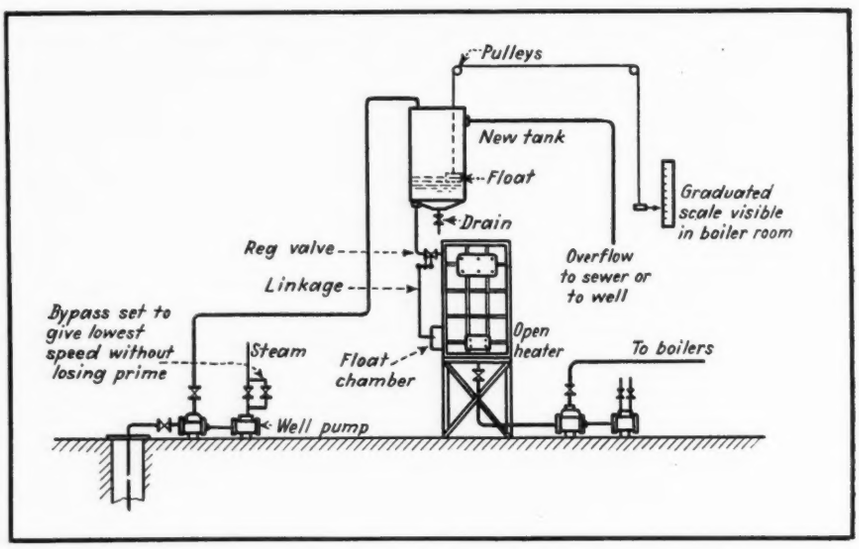

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valve opening. The float chamber can be located adjacent to the pump if necessary. It would be advisable to use largest pipe possible between the float chamber and the heater to facilitate prompt float action. HRT can manipulate the boiler-feed pump to maintain a fairly constant water level in the boiler and the float control will take care of the water in the heater and eliminate trouble. He will also find that the average feedwater temperature will be increased under these operating conditions, which improves the efficiency.

Duluth, Minn. E R WEBBER

Rolling Boiler Tubes

Answers to June Question 2

The Question

WHAT ARE THE OPINIONS *of* POWER *readers concerning tube rolling in boiler drums, headers, and economizers? Should tube-expander rollers have half the taper of the pin on all sizes of tubes or only on 2-in. and smaller tubes? Are 4-in. circulating tubes rolled with straight expanding rollers and a tapered pin? We would like to read discussions from other power-plant operators on the methods they have found most successful for different tube sizes.*—RNL

Use Good Judgment When Expanding Tubes

It seems that RNL has been paying more attention to the tapered pin than to the actual rolling of the tubes.

When using a roller tube expander with a tapered pin the job to be done is to expand tubes without worrying too much about how far the rolls should be on the taper, which is true for all sizes of tubes that can be expanded by the roller expander. If we go about measuring how far the rolls should be on the pin, the next thing we'll be doing is using micrometers to measure the pin for the actual diameter at different sections of the taper.

Tube expanders are made for all tube sizes, even combination expanders and flaring tools. I've used drift pins and collars, the old segment expanders, and the combination, and all work well. My advice is to use good judgement in expanding new tubes, but trust to your pin when re-expanding leaking tubes.

Grand Rapids, Mich. J M GORRIE

Plain Straight Rollers Are Satisfactory

RNL's tube rolling question is one that has long been open to argument among boiler makers, but men engaged in boiler repair work in the field have shown little interest in tube-expander construction details because the ones at hand give good results.

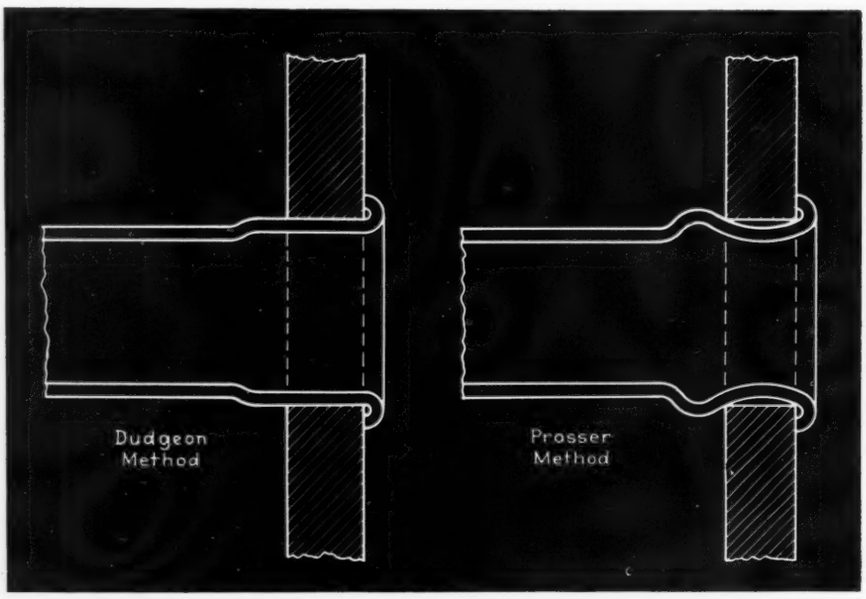
A brief analysis of the two principal types of expanders in general use, shows that they both accomplish the same results, but by different methods, and produce different effects on the tube ends, as shown in the exaggerated drawings. The chief mechanical difference is in the form of their expansive elements, but neither seems to possess any marked superiority over the other.

The Prosser expander, used extensively in locomotive practice, consists of a group of steel segments which expand the tube with a pressing action. The Dudgeon uses steel rollers which revolve and roll the tube to a tight fit. The acting portions of the segments in Prosser expanders have the shape to which the tube end conforms after being expanded; the flare imparted to the tube end is determined by the form of these segments. This expander causes a rather abrupt stretching of the tube metal instead of a gradual rolling. In the case of a vacuum forming in a boiler the Prosser method of expanding tubes might be considered advantageous because the tubes act to some degree as struts between the heads.

Expanders using rollers instead of segments are used mostly in watertube and general stationary practice. Flaring of tube ends with this type may be obtained with steeply tapered rollers, but tapered rollers for ordinary use can only produce the effect of expanding a tube tighter over one portion of its bearing surface than on other parts and may thus lead to damaging the tube by over-rolling.

Regardless of the size of tubes, if the tube holes are in good shape a satisfactory job of rolling can always be done with plain straight rollers and there seems to be no particular necessity for the use of tapered rollers.

Jersey City, N.J. I S CHAMBERLAIN



Helps to Center Tube

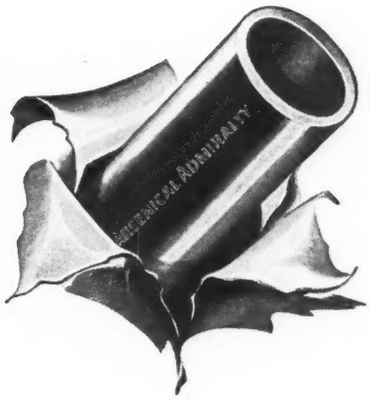
It has been our experience that tube expanders with straight expanding rollers and a tapered pin are quite successful for the 4-in. down to 2-in. tubes. We have had no occasion to use any tube expanders below the 2-in. size. We use a fairly short dead-end and 4-in. tube in our boilers and find that the tube-expander with the straight expanding rollers and tapered pin helps to center the tube and keep it in line during the rolling process.

Ansonia, Conn. W T ESTLICK

Thanks, Anyway

We wish to acknowledge answers submitted by the following readers for which space was not available: H D Brown, Lombard, Ill.; Edmund Malodey, Detroit, Mich.; John Hetherman, Lowell, Mass.; V C Summer, Parr, S.C.; W P Spining, Orange, N. J.; Carl Bachmann, Schenectady, N.Y.; J O G Gibbons, Bloomfield, N.J.; Anthony Greer, Bronx, N.Y.; B L Whismon, Rainelle, W.Va.; and C E Hackem, Detroit, Mich.

Increase resistance to DEZINCIFICATION!



USE ARSENICAL ADMIRALTY

No "cure-all" tube alloy, but one to consider if you're troubled with dezincification

THE AMERICAN BRASS COMPANY has been manufacturing Arsenical Admiralty Condenser Tubes on a commercial basis since 1934.

This alloy was introduced as a result of extensive research work, begun several years earlier, which demonstrated that the addition of a very small percentage of arsenic to the standard Admiralty Alloy materially increased its resistance to dezincification.

The consistently satisfactory performance of Anaconda Arsenical Admiralty Condenser Tubes in almost every kind of service has substantiated the results of laboratory tests.

While Anaconda Arsenical Admiralty Condenser Tubes have been quite generally used, they are especially well-adapted to those installations in which the older alloys showed definite tendencies to dezincify.

Technical Service Available

It is a function of the engineers of our Technical Department to assist Condenser Tube users in the selection of the most economical tube alloy for any given set of operating conditions. Please feel free to call on us. Publication B-2, sixth edition, gives up-to-the-minute data on Anaconda Condenser Tube and Head Plate Alloys. A copy will be mailed to you for the asking.

4283

ANACONDA from mine to consumer

Anaconda Condenser Tubes

THE AMERICAN BRASS COMPANY—GENERAL OFFICES: WATERBURY, CONNECTICUT

In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ontario • *Subsidiary of Anaconda Copper Mining Company*

ARGUMENT CORNER

Better Salt Improves Water-Softener Operation

THE ARTICLE "Backwashing Saves Gravel and Work" in June POWER, by P J Gordon, interested me because we have a similar installation, shown in Fig. 1, consisting of two water-softener tanks and a 1000-lb salt tank (saturator). To reduce the frequency of cleaning the saturator we did a little research work and found the answer in the quality of salt used. We are now using scientifically treated water-softening salt and although it costs twice as much as the salt we used previously, it gives results beyond expectations.

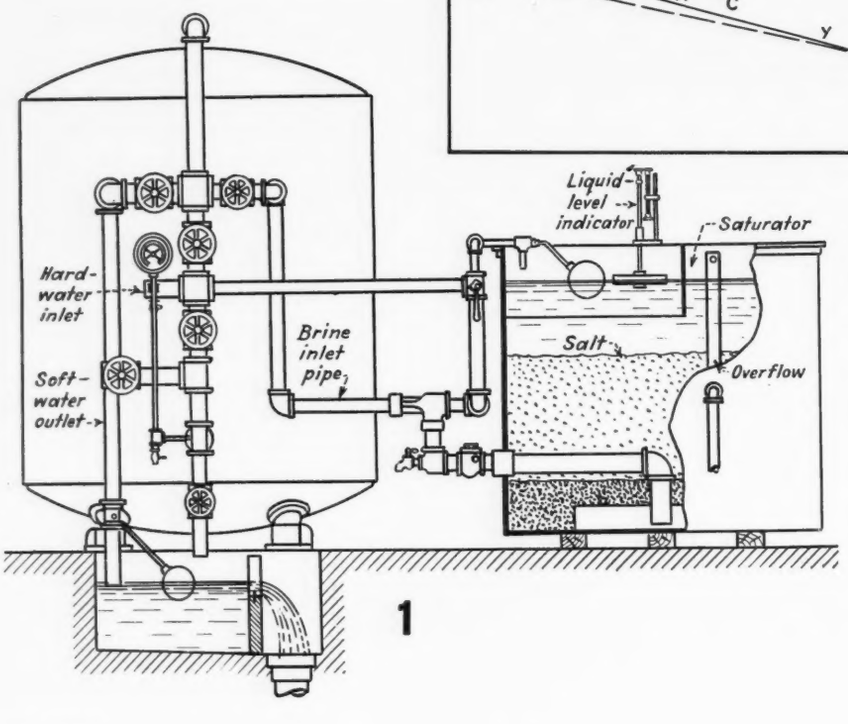
We now use only 25% the amount of salt previously used to produce the brine for regeneration of the water softener; we obtain 20% more zero-hardness water; backwashing and rinsing time (and consequently water used) reduced 33%; and regeneration of water softener has been reduced from four times to twice daily. This means that the backwashing, rinsing and regeneration total time has been reduced approximately 66%. Our present water-softening operation is the result of careful study and hourly check, extending over a period of two months, in cooperation with our watch engineers.

Any engineer interested in our method of regenerating water softeners may visit our plant or write for complete data to H O Kimball, Manager, Van Curler Hotel, Schenectady, N. Y.

Mr Gordon makes the statement, "we then put in a new charge of salt and fill the tank with fresh water and are ready for water softening." To clarify this statement for those not familiar with water-softener operations, it should read "and are ready for regenerating the zeolite of the water softener after which comes rinsing, then we are ready for water softening."

Schenectady, N. Y.

CARL BACHMANN



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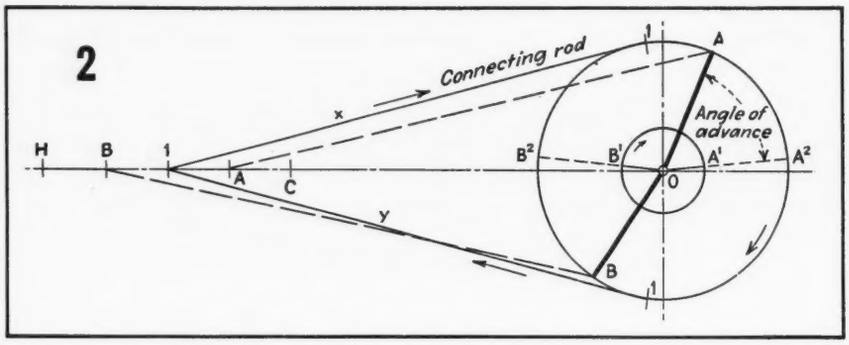
Connecting-Rod Angularity

I HAVE READ WITH INTEREST the answers in March POWER to WHS's question published in the January issue.

It seems to the writer that all of the answers have missed an important point, which is the angle made by the connecting rod at various points of the crank path with the horizontal centerline of the engine. To illustrate, I have drawn Fig. 2, in which the large circle is the path of the crank in making one complete revolution, the smaller circle is the path of the center of the eccentric (another form of crank), and the points *H* and *C* on horizontal line represent head and crankends of the stroke.

The solid lines *X* and *Y* represent the connecting-rod length and the position of wristpin and crankpin at half stroke in each direction. It will be noted that although the wristpin is at the same position, the crank positions are not diametrically opposite, but fall in the same vertical line on the head-end side of the shaft vertical centerline.

Let us consider for the purpose of illustration that the cutoff for both ends of the stroke is equal at half stroke. Examining the conditions of the crank and eccentric at wristpin position *A* on the forward stroke. *A* being located ¾ of the forward stroke, it is now observed that the crank has moved to position *A* on the crank circle. If cutoff is to occur on the forward stroke under control of the governor it must do so before the eccentric reaches its forward position. If it does not the valve will not unhook, as the motion will have reversed and the tail of the



valve hook will be moving away from the knockoff cam instead of toward it.

It will be assumed that cutoff occurs on the forward stroke when the center of the eccentric has reached point A^1 on the eccentric circle. If we now extend a line from center of shaft through A^1 to A^2 we can measure the angle of advance of the eccentric ahead of the crank. This will be the angle enclosed by the line from *A* to *O* and A^2. Now let us lay off on the center line the position *B* which represents the position of the wristpin at three-quarters of the crank-end stroke; laying off the connecting rod *B* — *B* on the crank circle we locate the crank position at three-quarters of the crank-end stroke. Since

(*Continued on page* 140)

RUST CLOSING IN ON YOUR TURBINES?

DON'T wait for rust to stop your turbines. It's far less costly to drain, flush and refill with new Shell Turbo Oil. Act now! You'll find new, tested and service-proved Shell Turbo Oil meets all 3 requirements of modern turbine lubrication:

RUST PREVENTION
SUPERIOR OXIDATION STABILITY
MINIMUM FOAMING TENDENCY

Don't accept less! Call in Shell now!

SHELL

Protect your turbines with RUST-PREVENTIVE

SHELL TURBO OIL

POWER LINES

A Ernest Thomas Awarded Grimshaw Medal

At the July 10 meeting of Greater New York Association, No. 1, National Association of Power Engineers, A Ernest Thomas, supervising engineer of the Dime Savings Bank, Brooklyn, N. Y., was presented with the Grimshaw medal for efficient isolated-plant operation. Presentation of the medal was made by Joseph F Carney, past national president NAPE. When presenting the medal Mr Carney paid high tribute to Mr Thomas as an engineer and his untiring efforts in the interest of the National Association of Power Engineers and to his outstanding contributions to power-plant and other fields of engineering.

Mr Thomas during World War No. 1 was an officer in the British Navy Reserve in charge of salvaging vessels sunk by mines and submarines and is well known for his lectures on mines and marine salvage work. Since joining National Association of Power Engineers in 1923 he has been president of Greater New York Association No. 1 and is now president of the New York State Association of NAPE, for the year 1942-1943.

The medal was made possible by a gift of the late Dr Robert Grimshaw, one of the founders of the American Society of Mechanical Engineers and the first editor of POWER, 1884 to 1886. Former recipients of the medal are Warren D Lewis, chief engineer, Hotel New Yorker; H W Wilds, chief engineer, New Life Insurance Co and past national president NAPE; W W Downey, director of engineering, New York Hospital Medical Center and national trustee, NAPE; Frank Smart, chief engineer, Beth Israel Hospital; J B Cubberly, supervising engineer, Mount Sinai Hospital; J C Goodrich, former chief engineer in several New York City plants; P F Cassidy; Joseph F Carney, building superintendent Waldorf Astoria Hotel, and a past national president NAPE, and Charles J Mason, for many years in engineering department, St Luke's Hospital.

Past National President NAPE, Joseph Carney, left, presents the Dr Robert Grimshaw Medal to A Ernest Thomas, president, New York State Association, NAPE

Cloud Wampler Elected Carrier Corp President

Cloud Wampler, executive vice-president, Carrier Corp, was elected president, succeeding the late J Irvine Lyle.

This action, taken by the Board of Directors recently, fills a vacancy left by the death of Mr Lyle.

At the same meeting Edward T Murphy, senior vice-president of the corporation, and one of its founders, was elected a member of the Board of Directors to succeed Mr Lyle.

Mr Wampler, who for many years resided in Chicago where he was identified with various business and civic

enterprises, has been closely associated with Carrier Corporation since 1934 when he became a member of its Board of Directors. Subsequently, he served as a member of the Executive Committee.

Prior to becoming executive vice-president of Carrier Corporation, Mr Wampler was president of Stern, Wampler & Co, Inc, of Chicago.

Tungsten Allocated Still Further

Tungsten, an essential ingredient of hard steel critically needed in war production and armament, was placed under further allocation and end-use control by an amendment to General Preference Order M-29, issued June 30 by the Director of Industry Operations.

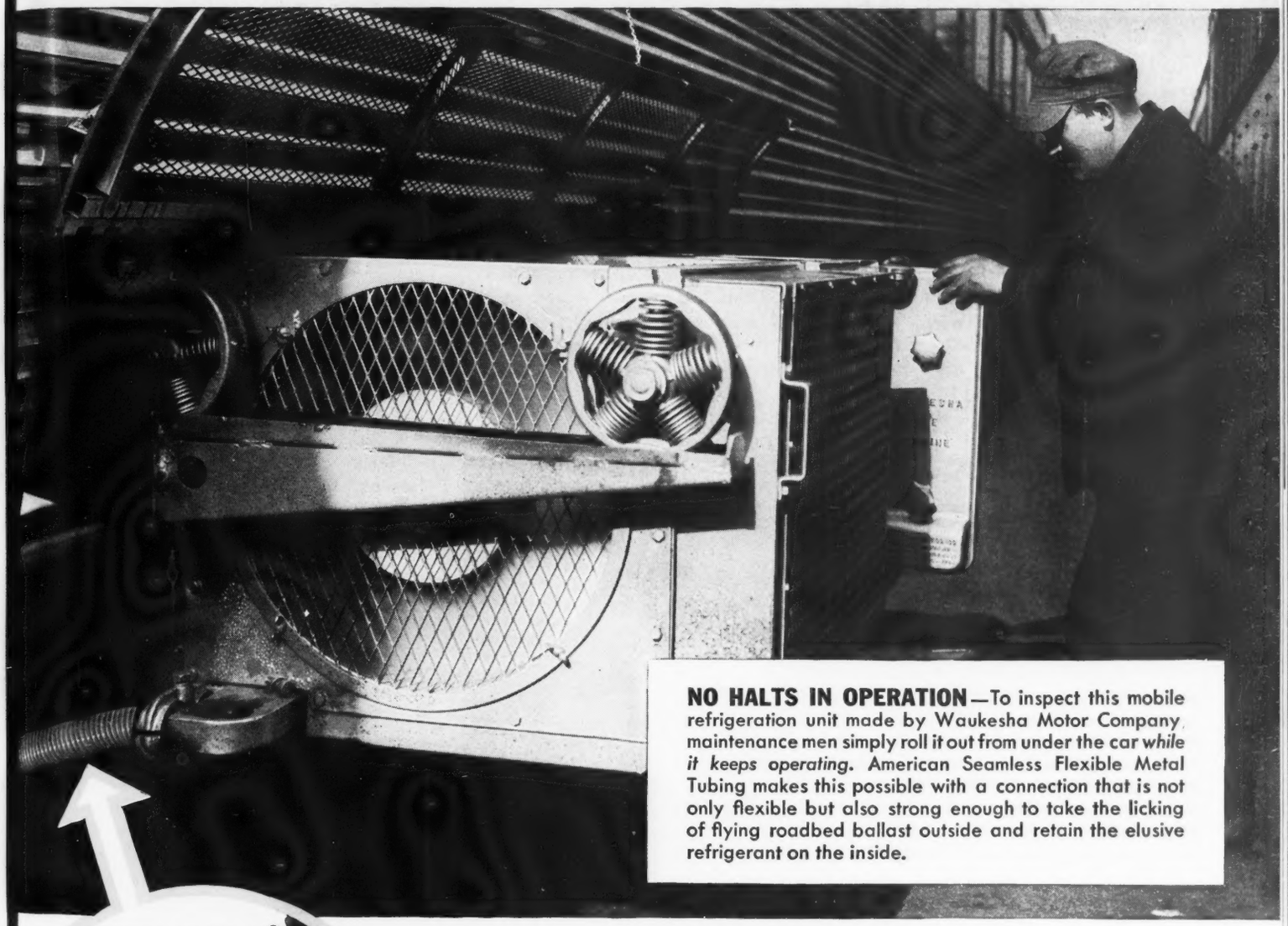
While tungsten is urgently needed for alloy steels, the small amount required for electric light bulbs will not be affected by this amendment, though allocation control in the original order still applies. The amount of contained tungsten which may be delivered to any one person in any one month without restriction is reduced from 100 lb, allowed in the original order, to a new maximum of 25 lb. Order M-29-A covered this point previously and it is

(*Continued on page* 194)

HERE, FLEXIBILITY HELPS SET A RECORD

Manufacturer of this mobile refrigeration unit says:

"The performance records of our units . . . are infinitely better than they would be if this roll out feature were not made possible by your flexible tubing."



NO HALTS IN OPERATION—To inspect this mobile refrigeration unit made by Waukesha Motor Company, maintenance men simply roll it out from under the car *while it keeps operating.* American Seamless Flexible Metal Tubing makes this possible with a connection that is not only flexible but also strong enough to take the licking of flying roadbed ballast outside and retain the elusive refrigerant on the inside.

FLEXIBLE METAL→ OUTSIDE ARMOR
←BRAIDED WIRE JACKET
←ONE PIECE CONTINUOUS SEAMLESS TUBING
←SECTION VIEW - NO SEAMS NO WELDS, NO PACKING

There's a strength advantage in American Seamless Flexible Metal Tubing as well as flexibility. Riding beneath this fast moving streamliner, roadbed ballast impinges forcefully on the connector's exterior. But, all-metal construction effectively withstands the rigorous service.

This combination of strength and flexibility has dictated the use of American Flexible Metal Hose and Tubing throughout industry as dependable connectors for the conveying of oil, steam, liquids, solvents and gases.

Naturally, your government has recognized the advantages of American Metal Hose. Today, it is working almost exclusively for our national war effort, directly in giant bombers and indirectly in helping to maintain uninterrupted production in war-vital plants.

42196

American Metal Hose

ANACONDA
from mine to consumer
REG. U.S. PAT. OFF.

AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS COMPANY
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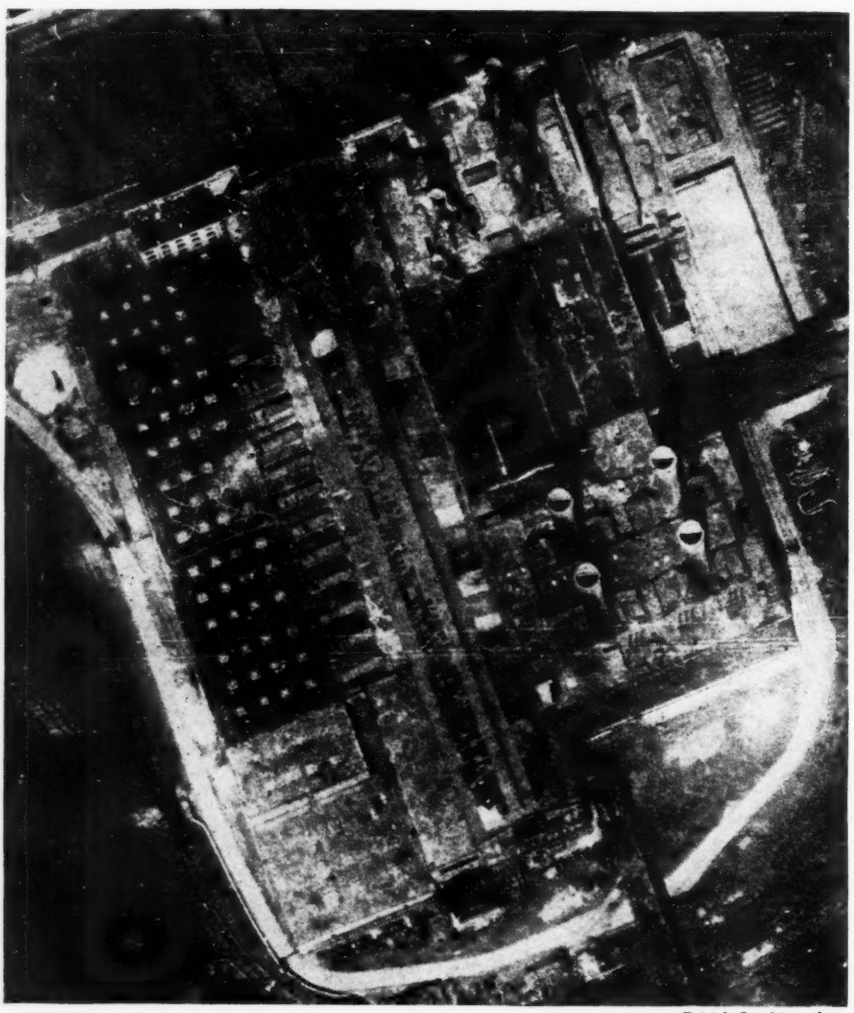
ENGINEERS' BOOKSHELF

Power Stations

ELECTRIC POWER STATIONS, VOLUME II (1941)—*By T H Carr, Published by D Van Nostrand Co, Inc, 250 4th Ave, New York, N. Y. 440 pages, 5½x8½ in., 130 illustrations, 45 tables, cloth binding. Price $9.00.*

This is volume II of a work dealing with large steam-power-plant design construction and operation in England. Volume I deals almost exclusively with the steam end of these plants, whereas this volume is devoted largely to the electrical equipment and is divided into 14 chapters: alternators; condensing plants; feedwater heating and water-treatment plants; transformers and reactors; switchgear; cabling and cables; lubricating, insulating and fuel oil; station auxiliaries; electrical protective equipment; station lighting; commissioning and testing of plants; organization; station costs; and fire fighting and air-raid precautions. A feature of this book is the very comprehensive treatment given to the selected subjects and the detailed data made available on the various types of equipment discussed. For example, in the chapter on alternators, data are given on the costs of 11-kv units, on stations with and without alternator transformers, on turbo-alternator reactances, on the stators and rotors of one 33-kv and two 11-kv alternators, on exciter systems for six different plants, and on ventilating-air coolers for four alternators. This presentation of tabulated data in Chapter I is typical of the other parts of the book. Diagrams are used freely to show equipment arrangement and electrical circuits. Where necessary to a clear understanding of the equipment and its operation detailed explanations are included. Practical mathematical analyses are introduced where necessary for an intelligent selection of equipment and illustrative problems worked out. Of particular interest at this time is the chapter on fire-fighting and air raid precautions. Even though this chapter gives a general picture of these requirements, many readers will probably like to see more detailed information on the experience in English power stations with air-raid precautions—what has been done in the plants to protect the equipment and the results obtained with the precautions. Throughout the work the treatment is unusually practical for a book on power-station design, so much so that it contains a wealth of information not only for power-plant designers but also for operating engineers.

HOW A PARIS POWER PLANT LOOKS TO THE RAF



British-Combine photo

Reconnaissance photo shows raid damage to Gennevilliers Station (about 300,000 kw) serving war-production plants in the industrial area of northwest Paris. Note "blitzed" stump of stack in upper center and top resting on roof nearby

Electricity

ELECTRICAL TRANSMISSION AND DISTRIBUTION REFERENCE BOOK (1942)—*By 14 Westinghouse central-station engineers. Published by Westinghouse Electric & Manufacturing Co, East Pittsburgh, Pa. 570 pages, 8½x11½ in., 732 illustrations, 130 tables, fabricoid binding. Price* $5.00.

Since publication, several years ago, of the late William Nesbit's authoritative book "Electrical Characteristics of Transmission Lines" many changes have occurred in the electrical transmission of power. Voltages have more than doubled, lines are longer, interconnections are more extensive and new methods of calculating power-system performance have been developed. These and other advances in electric-power transmission have pointed to the need of a new text on this subject. This book, the product of 14 Westinghouse central-station engineers, each contributing to one or more of the 19 chapters, deals with each aspect of electric-power transmission and distribution under these headings: general considerations of transmission, symmetrical components, characteristics of aerial lines, regulation and losses of transmission lines, steady-state performance of systems including methods of network

(*Continued on page* 186)

THE *Gilmer* NATIONAL POWER-RECOVERY PLAN

". . . we are glad to express our appreciation of your efforts in this direction," says WPB

INDIVIDUAL POWER-RECOVERY ESTIMATORS MAKE POWER-SAVING SIMPLE AND SYSTEMATIC . . . . .

Developed to help Industry convert power-waste into war production, the Gilmer National Power-Recovery Plan provides useful Power-Recovery Estimators . . . practical power-saving charts for each of these services —Electricity, Steam, Mechanical Transmission, Water, Compressed Air, Refrigeration, Boilers, and Prime Movers.

Compiled by leading power engineers, the Estimators are full of technically-sound suggestions, to help make power-saving a simple routine. In your hands, the Estimators cannot fail to produce results beneficial both to your plant and to your Country.

Take full advantage of the Power-Recovery Plan . . . use it to get the necessary executive support, then put it to work in your plant! Completely packaged in a special Booklet, it comes without cost or obligation. Write to Gilmer at once!

L. H. GILMER COMPANY • Tacony, Philadelphia, Pa.
The Oldest Firm of Rubber Fabric Belt Specialists

Authorities on power engineering estimate that, if Industry adopts the Power-Recovery Plan, the resultant power-saving will equal the combined output of two Boulder Dams!

What happens when a pipe line fails?

TODAY, when power fails — when a machine stops turning — the chances are that some sorely needed equipment is withheld from the fighting front.

Some soldier willing and eager to fight may never get a fighting chance.

For you may take it as a gospel of today's mechanized war that industrial *production* can mean battles won. That industrial *slow-downs* can mean battles lost . . . and hosts of our soldiers who'll never see home again.

That is why we can no longer risk "peacetime" interruptions. That is why no effort is too great to keep plants running full time. And one important step toward this end is to avoid slow-downs due to valve failures.

The management of any plant can avoid trouble *before it starts* . . . by instituting rigid inspection of valves . . . by adopting simple corrective practices. And production records have shown time and again that such care can return big dividends in eliminating lost man-hours.

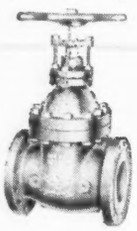
Have *your* valve equipment inspected by competent supervisors. And where this equipment must be operated by "green hands", provide adequate training. Make the valves you have last, for many of them are almost unobtainable today. If, in spite of care, valves must be replaced, install valves that will stand the gaff of all-out war production.

Jenkins Engineering Service will gladly advise you on problems of valve selection and maintenance. Jenkins Valves are available through good supply houses.

TRADE JENKINS MARK

Jenkins Bros.

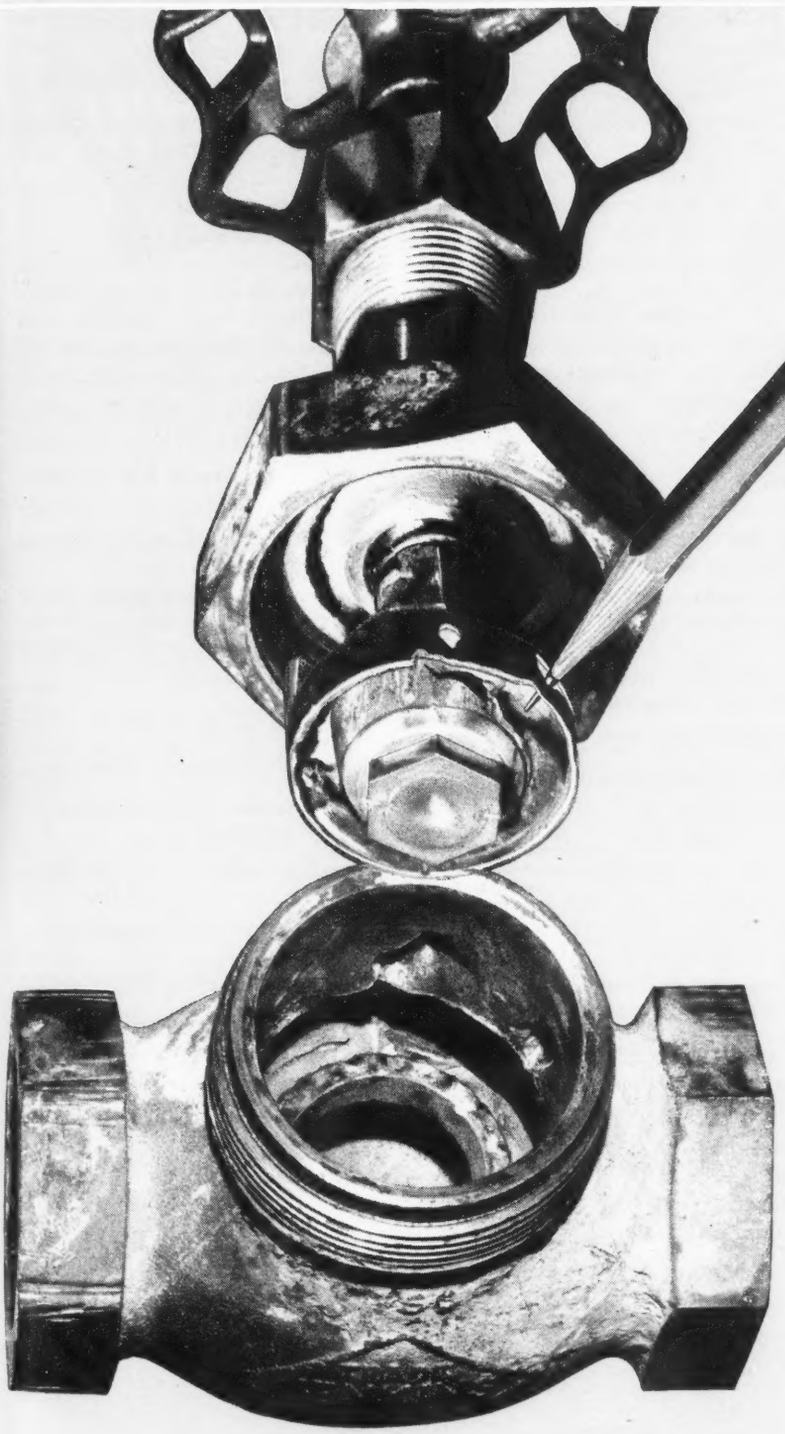
JENKINS BROS., 80 White Street, New York; Bridgeport; Boston; Atlanta; Philadelphia; Chicago; Houston. Jenkins Bros., Ltd., Montreal; London.



JENKINS VALVES

For every industrial, engineering, marine and power plant service . . . in Bronze, Iron, Cast Steel and Corrosion-Resisting Alloys . . . 125 to 600 lbs. pressure.

Valve troubles you can avoid *before they start!*



DESTRUCTION BY "WIRE DRAWING"

Illustrated is a Jenkins 106-A Bronze Globe Valve with Composition Seat, carelessly destroyed by the effects of wire-drawing.

This valve never had a chance! It was destroyed after only a short period of service because the seat, the body, the disc and the disc holder were cut out (wire drawn) from the effects of preventable leakage.

It was hurriedly and carelessly installed in a hot water feed line, and was incorrectly fitted with a disc for steam service – a disc too hard to seat tight in hot water service. Had it been originally fitted with a softer, more resilient disc, or had it been refitted with the proper disc at the first evidence of leakage, the valve would have lasted almost indefinitely.

Carelessness of this kind proves costly in repairs and interruptions to service, costly in materials all but impossible to replace today.

You can avoid troubles like this *before they start,* by (1) *Proper installation,* and (2) *Regular inspections.*

JENKINS VALVES

BRONZE...IRON...STEEL

Pump-Trouble Check Chart

► Investigation shows that the majority of troubles with centrifugal pumps result from faulty conditions on the suction side. However, the following pointers on finding centrifugal-pump troubles include certain installation and mechanical defects.

No water delivered

1. Priming—casing and suction pipe not completely filled with liquid.
2. Speed too low.
3. Discharge head too high—check vertical head, particularly friction loss.
4. Suction lift too high (suction pipe may be too small or long causing excessive friction loss). Handling cold water, total lift including friction loss in suction pipe should not exceed 15 ft, nor in any case be more than ⅔ total head. Check with gage.
5. Impeller, suction pipe, or opening completely plugged.
6. Wrong direction of rotation.
7. Air pocket in suction line.
8. Stuffing-box packing worn—or water seal plugged—allowing leakage of air into pump casing.
9. Air leak in suction line.
10. Not enough suction head for hot water or volatile liquids. Check carefully as this is a frequent cause of trouble on such service.

Not enough water delivered

1. Priming—casing and suction pipe not completely filled with liquid.
2. Speed too low.
3. Discharge head higher than anticipated—check, particularly friction loss.
4. Suction lift too high (suction pipe may be too small or long causing excessive friction loss). Handling cold water, total lift including friction loss in suction pipe should not exceed 15 ft nor in any case be more than ⅔ total head. Check with gage.
5. Impeller, suction pipe, or opening partially plugged.
6. Wrong direction of rotation.
7. Air pocket in suction line.
8. Stuffing-box packing worn—or water seal plugged—allowing leakage of air into pump casing.
9. Air leak in suction line.
10. Not enough suction head for hot water or volatile liquids. Check carefully as this is a frequent cause of trouble on such service.
11. Foot valve too small.
12. Foot valve not immersed deep enough.
13. Mechanical defects such as wearing rings worn, impeller damaged, or casing packing defective.

Not enough pressure

1. Speed too low.
2. Air in water.
3. Measure impeller diameter.
4. Mechanical defects such as wearing rings worn, impeller damaged, or casing packing defective.
5. Wrong direction of rotation.
6. Be sure pressure gage is in correct place (not on top of casing).

Pump works for a while and then quits

1. Leaky suction line.
2. Stuffing-box packing worn—or water seal plugged—allowing leakage of air into pump casing.
3. Air pocket in suction line.
4. Not enough suction head for hot water or volatile liquids. Check carefully as this is a frequent cause of trouble on such service.
5. Air or gas in liquid.
6. Suction lift too high (suction pipe may be too small or long causing excessive friction loss). Handling cold water, total lift including friction loss in suction pipe should not exceed 15 ft nor in any case be more than ⅔ total head. Check with gage.

Pump takes too much power

1. Speed too high.
2. Head lower than rating: pumps too much water.
3. Liquid heavier than water. Check viscosity and specific gravity.
4. Mechanical defects such as bent shaft, binding rotating element, too-tight stuffing boxes, misaligned pump and driving unit.
5. Wrong direction of rotation.

Pump leaks excessively at stuffing box

1. Packing worn or not properly lubricated.
2. Packing incorrectly inserted or not properly run in.
3. Packing not right kind for liquid handled.
4. Shaft scored.

Pump is noisy

2. Hydraulic noise-cavitation, suction lift too high. Check with gage.
2. Mechanical defects: shaft is bent, rotating parts bind, are loose or broken, bearings are worn, pump and driving unit are misaligned.

Goulds Pumps, Inc.

© POWER

Why a Thermostat?

Periodically, over 33 years, we have been asked this question. Uncle Sam asked it recently. The answers landed one of our largest government orders for Feed Water Regulators. Our own research staff is continually answering this question by experimenting with every known valve actuating force and with some not generally known. Over 60,000 users of COPES Thermostats answer the headline question this way.

1. The COPES Thermostat is simple, positive and rugged. It utilizes the expansion and contraction principle to develop a powerful mechanical force.

2. The COPES Thermostat responds quickly and evenly to load changes as reflected by changing water level. (5 to 8 times faster than an other common method.)

3. The COPES Thermostat is completely automatic, permanently accurate and dependable.

4. The COPES Thermostat will outlast the boiler it protects—requires nothing more than routine inspection.

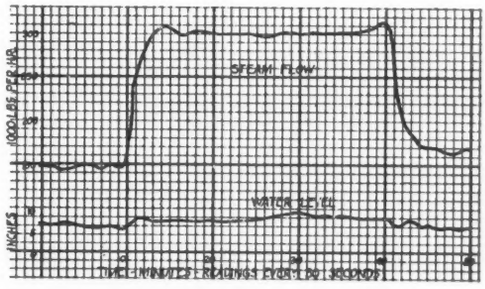
5. COPES Thermostats are used outdoors on hundreds of boilers subject to the elements from −40°F. to +110° F. They can take it.

6. COPES Thermostats are made in several types to meet the space requirements of any installation on land or sea encountered in over 33 years of specialized Boiler Feed Water Control experience.

7. COPES Thermostats are proving these qualities in over 60,000 applications with boilers of all makes from 400 lbs. to 1,000,000 lbs. per hour capacity at all pressures up to 1900 lbs. under all kinds of load conditions in every part of the world.

For the benefit of new operating personnel in your power plant, write for text book titled, "Mechanical Feed Water Regulation for Boilers." For information about Flowmatic, the modern 2-element steam flow-control, write for booklet 409-B.

MORE THAN 60,000 COPES THERMOSTATS . . . Are Helping Make Charts Like This



The load charted on this central station boiler jumped from 150,000 to about 300,000 pounds per hour within 3½ minutes, the boiler water level rose only 2½ inches. This close stabilization of the water level was provided by a COPES Flowmatic Steam-Flow Type Regulator, adjusted to maintain a slightly higher level on heavy loads than on light. Flowmatic permits adjustments to provide any boiler water level characteristic desired.

NORTHERN EQUIPMENT COMPANY

821 GROVE DRIVE, ERIE, PENNSYLVANIA

Feed Water Regulators, Pump Governors, Differential Valves
Liquid Level Controls, Reducing Valves and Desuperheaters

BRANCH PLANTS IN CANADA, ENGLAND REPRESENTATIVES EVERYWHERE

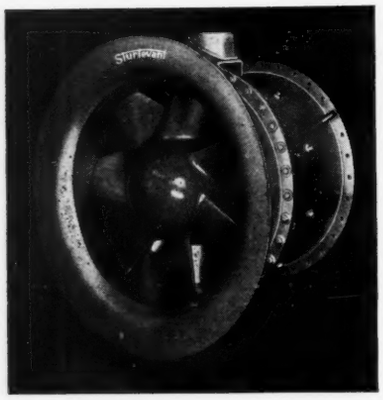
★ GET CLOSER LEVEL CONTROL WITH THE COPES FLOWMATIC ★ REGULATOR

FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY

WHAT'S NEW IN PLANT EQUIPMENT

Axial Flow Fan

VICTORY AXIFLO fan is at present restricted to U. S. Navy work, but will be available to general industry after the war. Consists of a multi-blade wheel direct-connected to an enclosed motor mounted in a spoke assembly in the housing, the spokes serving as air-flow straighteners. Mechanical efficiency of the fan is claimed to be over 90%. Made



in pressure ranges from ½ in. to 6 in. water column in the motor-driven types; 60 in. water column for turbine-driven. *B F Sturtevant Co, Hyde Park, Boston, Mass.*

Oil-Immersed Starters

STARTER LINE INCORPORATES design features which facilitate installation, service and operation. Easier installation is provided through use of a cast head with a wiring manifold which permits

conduit entrance from five directions. A removable cover plate facilitates threading of bare wire through an insulating spacer above the oil bath. Welded-seam tank designed for a minimum quantity of oil, while a large window-type oil-level gage provides quick, clear visibility. For efficient operation, magnetic overload relays are easily adjustable to meet prevailing conditions of application. Either hand or automatic reset relays are available. Removal of the tank from a combination starter automatically throws the breaker to "off" position. Two kinds of starters available—(1) Corrosion resisting and (2) explosion resisting for class I, group D hazardous locations. *Square D Co, Industrial Controller Div, 4041 N Richards St, Milwaukee, Wis.*

Wood Bearings

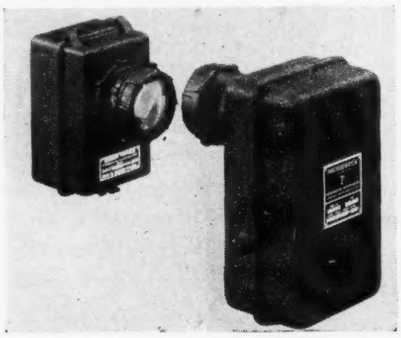
WOODEX is trade name of wood made from selected portions of all sap rock maple, impregnated with various oils and other lubricants. Furnished in the form of bearings and formed-to-size parts, it can be machined easily. Maker says that while Woodex will not stand the load, speed or high temperatures that graphited bronzes will, it will outwear most metals when installed in applications for which it is intended. Maker emphasizes that Woodex is not a substitute, but has been a recognized bearing material for almost 40 years. *Neveroil Bearing Company, Wakefield, Mass.*

Hard-Facing Rods

COMPANY CAN FURNISH these rods under regular A-10, P-100 ratings. Stoodite K is a cast hard-facing rod consisting principally of molybdenum, tungsten, manganese, silicon, carbon and iron. It is supplied in bare form for oxyacetylene application and in coated form for dc electric applications. Deposits average 54–58 on Rockwell C scale, depending on parent metal and method of application. Stoody self-hardening K is composed principally of molybdenum, manganese, silicon, carbon, vanadium and iron and is made in the form of tubes with mixed alloys on the inside. Deposits average 50–54 Rockwell C depending on parent metal and method of application. Forms an excellent bond with manganese steel and can be used for hard-facing various types of manganese equipment. *Air Reduction Sales Co, 60 East 42nd St, New York, N. Y.*

Photoelectric System

TYPE A28L CONTROL is for outdoor and indoor use over very long ranges. Light source projects a practically invisible light beam for distances of 350 to 700 ft and it is possible to completely sur-

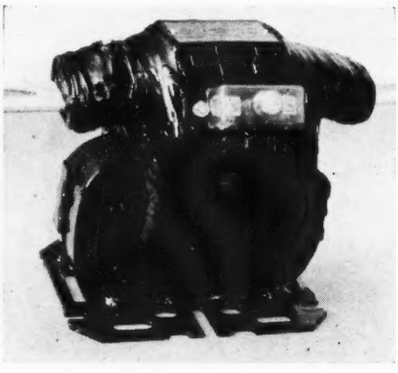


round power plants, factories, and other vital areas. If the light beam is broken photoelectric control contacts close, sounding alarms, operating a central station system, turning on floodlights, closing gates, etc. Control is provided with a latching unit including a push-button station. This serves to latch alarm in operation once light beam has been momentarily broken until reset button is operated. Control is said to be unaffected by changes in local light and is designed to operate 24 hr a day. *Photoswitch Inc, 21 Chestnut St, Cambridge, Mass.*

Indoor Current Transformer

TYPE CT INDOOR current transformer has a current rating of from 10 to 800 amp primary and 5 amp secondary; voltage ratings are 5, 8.7 and 15 kv. Definite primary terminal dimensions are set for distance between centers of

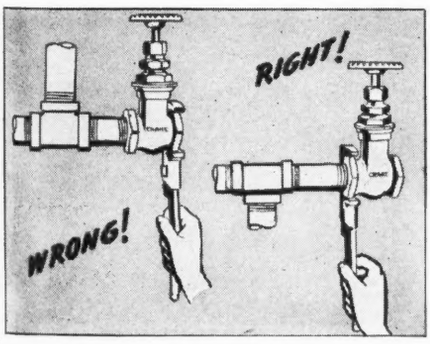
(*Continued on page* 142)



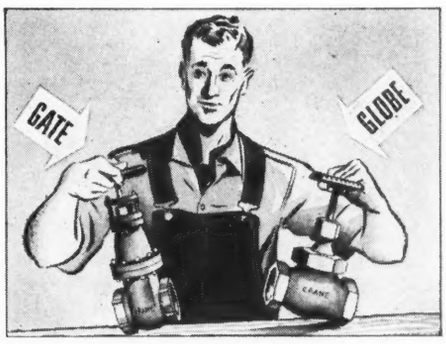
Kinda give it your personal attention, will you?
GOOD PIPING SERVICE BEGINS WITH GOOD INSTALLATION!
For Defense
INSTALL PIPING RIGHT!

HELP FOR FIGHTERS ON THE *Home Front*

You and they have two big jobs—(1) meeting the gigantic demands of war production, (2) keeping your plant in shape to meet those demands. That means proper maintenance—with a capital "M"! Long before Pearl Harbor, Crane Co. saw this need, and inaugurated "Piping Pointers"—to help you and them do the job. Today, these Crane bulletins on better installation and care of piping are training new workers and spreading the gospel of proper maintenance—for continued peak production, for conservation of critical materials—for Victory! These examples show how they're doing it:



TREAT PIPING RIGHT is rule No. 1 in making present valves and fittings last longer—give maximum service. In "Piping Pointers," Crane tells maintenance men exactly how to do it—how to avoid little careless habits that shorten the life of equipment—how to prevent replacements now when replacements are harder to get.



PICKING THE RIGHT VALVES for specific services is a sure way to eliminate interruptions and delays in production lines. Crane "Piping Pointers" give clear directions on valve selection. Maintenance workers using these practical hints know when, where, and why to install gate valves — and when to choose globe, angle or check valves.

FOR TRAINEES OR VETERANS—Men who never handled a wrench before quickly grasp the *dos* and *don'ts* and *rights and wrongs* in "Piping Pointers." They keep veterans up-to-date on *"kinks"* that speed up work and step up efficiency of piping. For the many plants using this Crane service, it means greater freedom from shut-downs—*more production!*

FREE—TO ANY PLANT—TO HELP SPEED VICTORY! Your local Crane Representative will gladly supply "Piping Pointers" on request. Or, write to address given at right. No obligation.

CRANE

CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVE., CHICAGO

VALVES • FITTINGS • PIPE • PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

Mr. Smith Looks at Washington

JOHN SMITH isn't stupid. He is the average American citizen, and he is just as much concerned about our progress in the war as are the bigwigs in Washington who are now in control.

If he were asked for his recommendations to expedite the war effort and to achieve still greater national unity, this would be his reply:

That the government stop treating us like children who are too young to know the facts of life and stop the vicious practice of playing up the good war news and playing down the bad.

That Washington have the courage to go ahead and make all-important war policy decisions NOW instead of waiting until after the November elections.

That one government official instead of three or four speak authoritatively on one subject, thus avoiding repetition of the confusion that has surrounded gasoline rationing from the beginning.

That members of Congress refrain from making reckless and totally inaccurate statements about subjects of which they have no knowledge, such as rubber, their main purpose apparently being to soothe the home folks into thinking that everything soon will be lovely.

That government agencies stop the senseless practice of causing heavy runs on a consumer product by announcing prematurely that it soon will have to be rationed.

That the government stop voicing its endorsement of wage stabilization unless it is prepared to freeze wages as it has tried to freeze prices in an effort to guard against inflation.

That farm blocs and employer blocs and union labor blocs and blocs of any kind whatsoever have no place in our nation, because the only way that we can hope to win this most difficult of wars is to hold steadfastly to the policy of "one for all and all for one."

This editorial by Burnham Finney, editor of *American Machinist*, is one of the best expressions I've seen of the feelings of all of us. I thought you'd want to see it, too.
—GEORGE EDWARDS, *Engineer*

IF YOU WANT TO CUT DOWN ON RE-PACKING... BETTER TRY SEA RINGS!

It's not packing— it's RE-packing that's really expensive . . . that's why it pays in dollars and cents to use the best packing money can buy. J-M Sea Rings are that kind of packing.

They're custom-made to fit specific operating conditions. Entirely automatic, they seal on the work stroke, release on the return, thus reducing friction and wear on both packing and rod. During the past 25 years many engineers have accepted Sea Rings as the standard packing for reciprocating rods and plungers operating against steam, water, air, brine, oil, gasoline and many other fluids and chemicals.

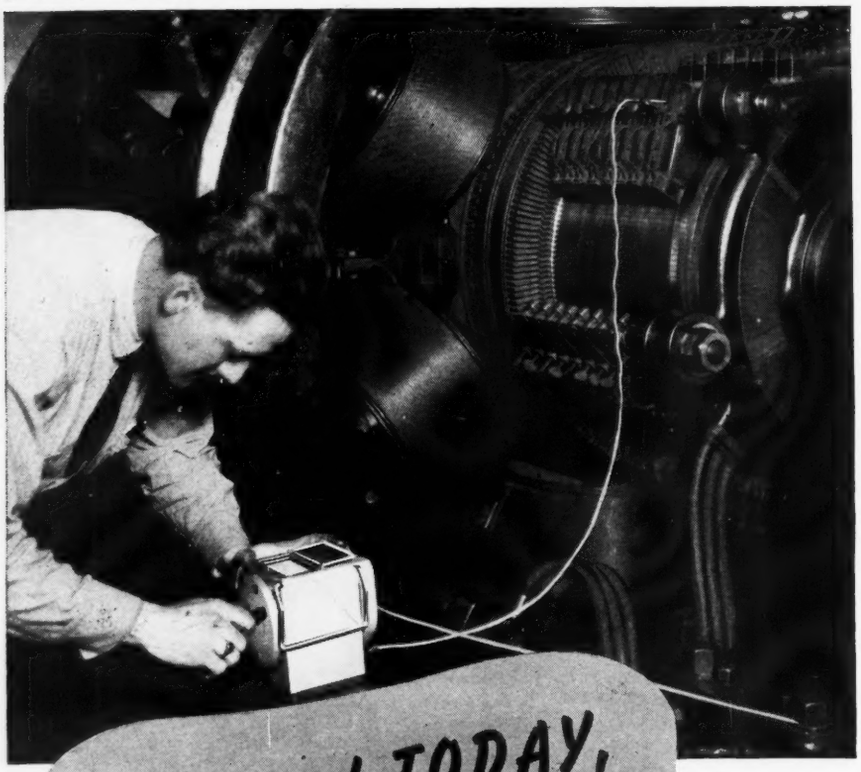
For details on J-M Sea Rings and the complete line of J-M Packings and Gaskets, write Johns-Manville, 22 E. 40th St., New York, N.Y.

JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

THERE'S A DISTRIBUTOR NEAR YOU

TAKE TIME TO TEST . . . *and* SAVE TIME



. . . and TODAY, TIME is priceless

Although "Megger" Insulation Testers have been used for years by industry to detect and forestall electrical breakdowns, their use today has assumed an importance out of all proportion to the cost of the instrument—or the amount of time spent in using it. It is not merely a matter of dollars and cents. Production time is priceless . . . and electrical equipment is most difficult to replace. *Minutes* with a "Megger" Tester can save *Days* of delay.

Under the stress of present demands, everyone who is directly or indirectly responsible for keeping motors, generators, wiring and other electrical equipment in good operating condition, should be fully acquainted with the advantages to be gained by the use of a "Megger" Tester. Write us for a free copy of the Pocket Manual of "Megger" Practice No. 1420-P.

JAMES G. BIDDLE CO.
1211-13 ARCH STREET • PHILADELPHIA, PA.

"MEGGER"
TRADE MARK REGISTERED U.S. PAT. OFF.
Insulation Testers, Ground Testers and Ohmmeters

Argument Corner

(*Continued from page* 126)

the angle of advance remains the same we can now lay off on the crank circle the distance B–B^2 equal to A–A^2. Drawing a line from B^2 to O at shaft center we locate on the path of the eccentric center the position B^1 which is the center of the eccentric corresponding to crank and wristpin positions B.

It will now be observed that the eccentric center B^1 has passed the horizontal line before the crank B has reached a position corresponding to three-quarters cut off for the crank end; hence its motion has reversed and the tail of the valve hook is traveling away from the knockoff cam and cutoff will not occur under the control of the governor. In other words, the valve remains hooked on for the return or crank-end stroke although it cut off at three-quarters stroke on the forward or head-end stroke.

It would appear that WHS must decide at what point in the stroke he is to have equal cutoff on both ends; if this point is at half stroke the cutoff will not be equal at maximum or vice versa.

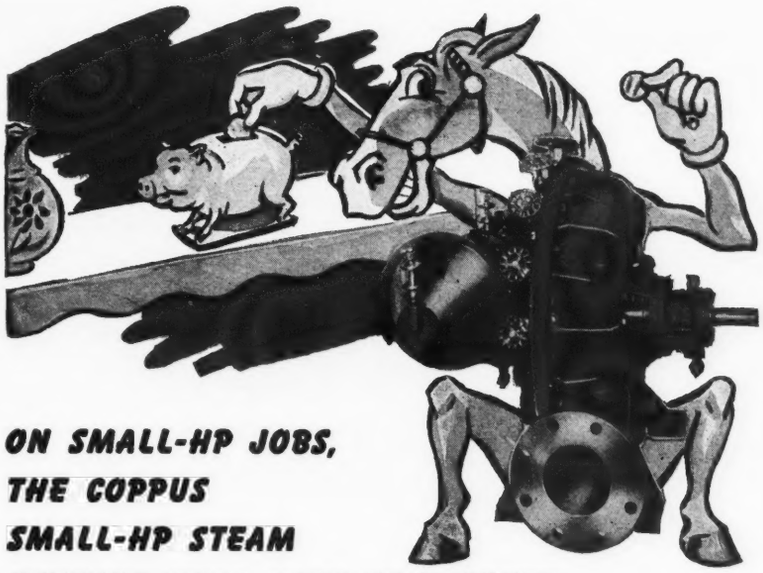
The shorter the connecting rod with relation to the stroke the greater will be the angularity of the connecting rod on the points of cut-off. While some result may be obtained by adjustment of governor rods it is the writer's opinion that since the trouble is inherent in all reciprocating engines it will be difficult to overcome by this means.

Plymouth, Mass. C B HUDSON

Testing for Phosphates

IN FEBRUARY POWER there appeared an article by George A Johns on "Convenient Colorimetric Test for Phosphates" in which the author stated "However, two of the older colorimetric methods (stannous chloride and hydroquione) can be discarded. Phosphate determination by the reduction of ammonium phosphomolybdate with stannous chloride is susceptible to gross errors from interfering ions, particularly silica."

We have been using stannous chloride as a reducing agent in the determination of phosphate in boiler waters for over ten years and have found it to be the most satisfactory one available if properly employed. Interference of silica depends on the acid and molybdate concentrations and not on the reducing agent. If insufficient acid is present,



ON SMALL-HP JOBS, THE COPPUS SMALL-HP STEAM TURBINE WILL SAVE YOU MONEY

You can get steam turbines in smaller frame sizes from Coppus than from most other makers whose smallest turbine is usually in a 100 H P frame. Coppus includes six sizes from 150 H P *down* to fractional.

Save money on initial investment (and save floor space, too) by selecting the proper size turbine from the Coppus line.

And when you see the blue band on the flange, you'll know you are getting a Coppus "Blue Ribbon" value — precision workmanship throughout. That's why so many manufacturers of pumps, blowers, stokers, mixers, etc., prefer to equip their products with the turbine that wears the blue ribbon.

Bulletin 135-9 will give you full facts. Check the coupon.

COPPUS

"WE GET BOILER EFFICIENCY OF AROUND 80% DAY AFTER DAY"

"Am very much pleased with their operation," writes this power company Chief Engineer about his Coppus-Dennis Fanmix Burners. "Operating an entirely automatic 400 H P boiler, and using natural gas, we get boiler efficiency of around 80% day after day. These burners pick up sudden load very nicely with perfect combustion."

COPPUS

Check the coupon to request Bulletin 410-3 describing further advantages of this "Blue Ribbon" product.

COPPUS BLUE RIBBON PRODUCTS

DESIGNED FOR YOUR INDUSTRY...ENGINEERED FOR YOU

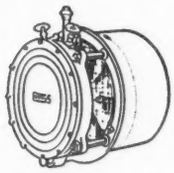
COPPUS ENGINEERING CORPORATION

323 Park Avenue, Worcester, Mass.

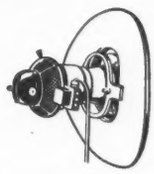
Sales Offices in THOMAS' REGISTER. Sweet's Product Reference.

You'll get valuable ideas from these free bulletins on other Coppus Blue Ribbon Products

(Check the ones you want)



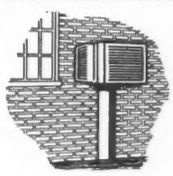
☐ Coppus Type C Turbo Blower. For undergrate draft. Bulletin 145-6.



☐ Coppus Boiler Manhole Blowers and Exhausters. For cooling boilers, drums, etc. Bulletin 161-3.

☐ Coppus Cable Manhole and Tank Ventilators. For confined working spaces. Bulletin 163-1.

☐ Coppus Heat Killers. Keep production up by keeping men cool. No stale air recirculation. Air is directed. Bulletin 160-5.



☐ Coppus Air Filters. For engines and air compressors. Perfect, uninterrupted filtration. Bulletin F-310-4.

☐ Coppus-Dennis Fanmix Gas Burner (described in this ad).

☐ Coppus Steam Turbine (described in this ad).

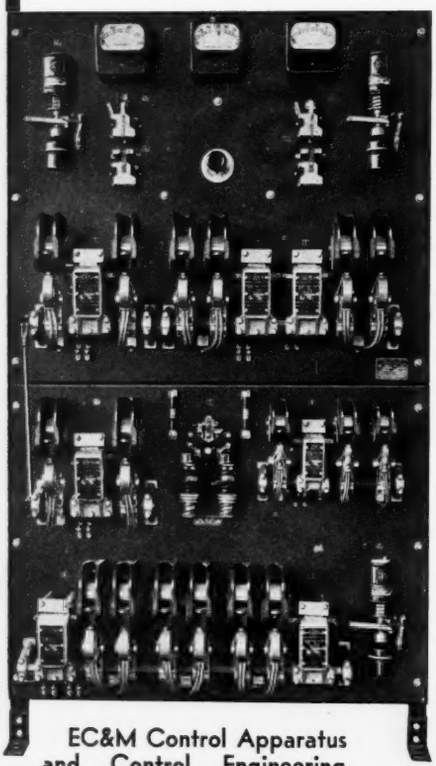
NAME.....

COMPANY.....

ADDRESS .....

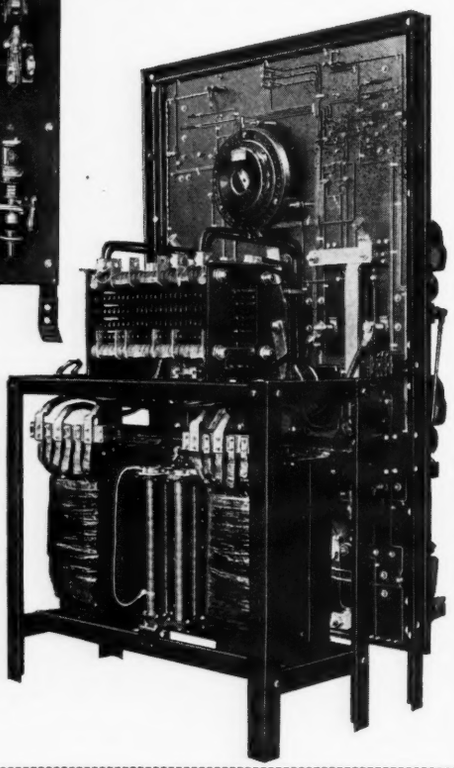
...THEY COULDN'T AFFORD A SHUTDOWN

M-G Set Brought Up To Speed Safely —and Without Tripping Breaker



Customer's power service was loaded to capacity. A Standard Motor Starter was tried out but it frequently failed to bring the motor up to speed without causing the main power breaker to trip and shut the whole plant down.

An EC&M representative was called in. The starter recommended by EC&M performed successfully from the beginning and has not caused a single shutdown.



EC&M Control Apparatus and Control Engineering rank at the top for the solution of difficult control problems. This EC&M Combination Auto-transformer and Primary-resistor Starter for reduced voltage starting of 400 HP, 440 Volt Synchronous Motor-Generator Set is only one of many illustrated and described in our 24-page Booklet No. 88 on Custom Built Motor Control. Mail the coupon today for your copy.

THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS.

THE ELECTRIC CONTROLLER & MFG. CO.
2711 E. 79th St., CLEVELAND, OHIO

Gentlemen:
Please send me a copy of illustrated Booklet No. 88 describing EC&M 110 to 550 volt Motor Starters.

Name .....

Company .....

Address .....

P-8-42

silica will interfere no matter what reducing agent is employed. If excess acid is used, no color will develop even when both ortho-phosphate and silica are present.

The Taylor Phosphate Slide Comparator uses an acid molybdate reagent and stannous chloride as reducing agent. The stannous chloride is furnished as a concentrated acid solution which can be conveniently diluted each day. Both reagents will give accurate results even after five years storage.

With the Taylor High Phosphate Comparator (5-100 ppm PO_4) interference by silica is practically non-existent since concentrations of silicate up to 10,000 ppm as SiO_2 cause no error. Interference from iron, sulfites, chlorides, etc is negligible. Color formation is practically instantaneous and the color undergoes no change for at least 10 minutes. Since the permanent color standards are mounted in an easily manipulated plastic slide, a determination requires but a minute.

The extensive use of phosphate-testing outfits using stannous chloride in power plants, institutions, industrial plants, etc, is proof that this reducing agent can give accurate results when properly applied.

Baltimore, Md.

W A Taylor,
W A Taylor & Co

New Equipment

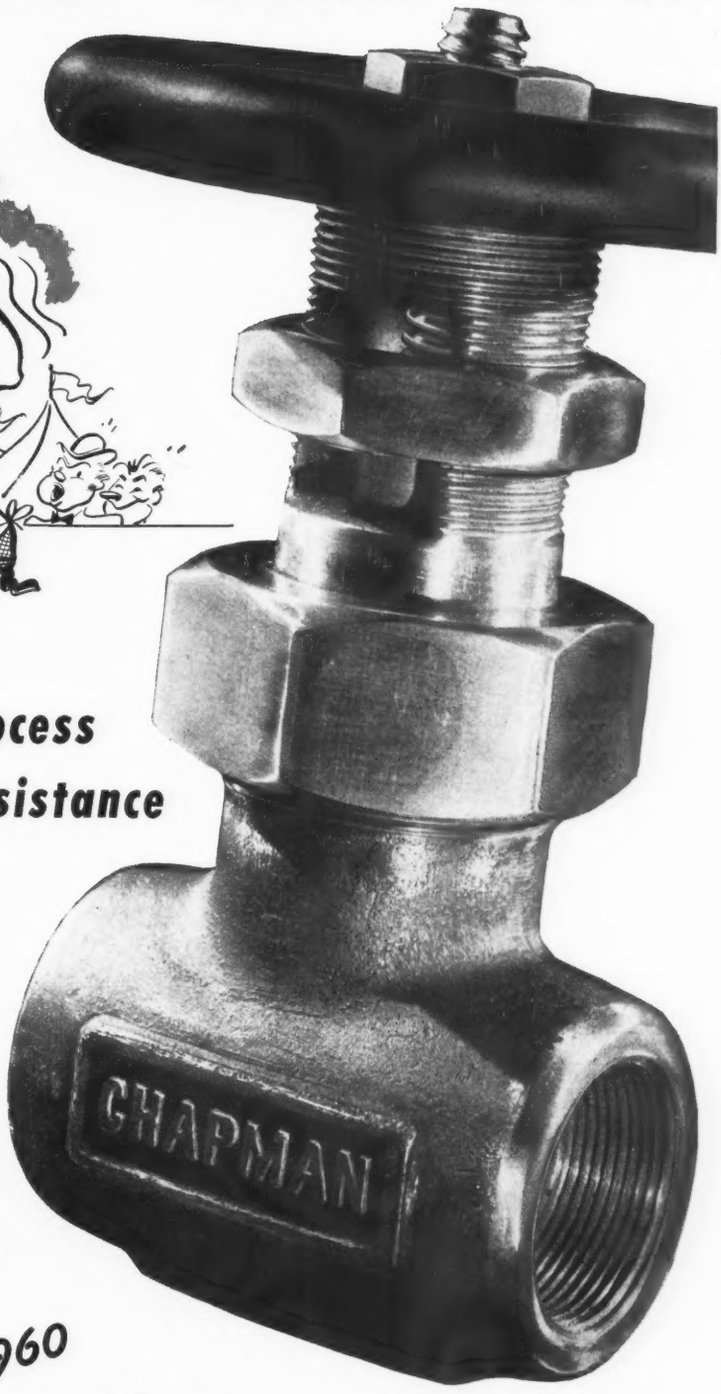
(*Continued from page* 136)

outside terminal holes, size of hole, size of slot, distance from base to under side of terminal and over-all height from mounting base to transformer top. Therefore any standard type CT transformer is interchangeable with any other in its voltage class regardless of current rating. *Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Radiator Trap

"Old Ironsides" line of wartime radiator traps and valves features cast iron bodies and bonnets in natural finish for painting after installation. Nickel and other plating eliminated. Brass formerly used in trap and valve bodies, caps, nuts, etc is conserved. New trap and valve are designed for connection to the radiator with a right and left-hand pipe nipple—a practice that was commonly used years ago and is now resorted to because of the important savings resulting. Traps are limited to three sizes—½ in. for 200 sq ft, ¾ in. for 400 sq ft

Now Tougher than Ever



...exclusive Chapman process gives even more wear-resistance to List 960 Small Valves

Chapman List 960 has always been tougher and longer-lived than any similar type of small valve. And now it's even tougher . . . thanks to the new Chapman process which *super-hardens* the renewable stainless seat rings and wedges. This longer life is especially important under today's conditions which call for utmost endurance from all plant equipment. So on all lines from ¼" to 2", get this *extra measure* of positive, easy-acting Chapman service . . . plus also the time-saving convenience of being able to repack the valve under full pressure on the line. Outside or inside rising stem types. Write.

List 960

Chapman Small Gate Valves

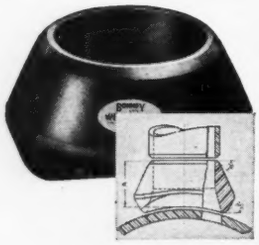
...with Specially Super-Hardened seats and wedges

THE CHAPMAN VALVE MANUFACTURING CO., INDIAN ORCHARD, MASS., U.S.A.

WELDOLETS·
TRADE MARKS - REG. U. S. PAT. OFF.
THREDOLETS
. . . Welded Outlets for Piping . . .

How to Make Right-Angle Welded Branch Pipe Outlets Stronger, Better and at Less Cost

WELDOLETS, ThredOlets and Socket-End WeldOlets overcome every fault and weakness of pipe-to-pipe welded intersections. They eliminate all templets . . . the fitting is used as a templet . . . the necessity of cutting a symmetrical hole in the main pipe . . . shaping the end of the branch pipe to fit that hole . . . the sharp, right-angle turn which sets up stresses and weakens the junction . . . turbulence and friction, which restricts flow, caused by the sharp 90° turn.

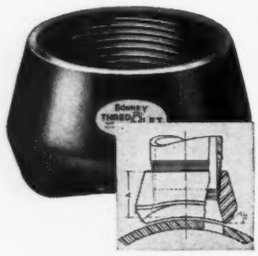


WELDOLET

Showing the externa rib and the blending of ear portion of fitting to pipe wall. Note ease of inspecting inside of joint for excess weld metal.

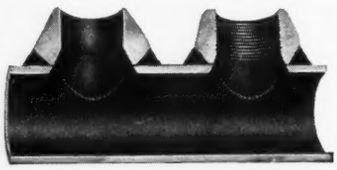
WeldOlets, ThredOlets and Socket-End WeldOlets are designed to produce wide, funnel-shaped, right-angle welded branch pipe outlets which reduce turbulence and friction to a minimum, producing better flow conditions.

Their heavy, external rib amply compensates for loss of strength in the main pipe when the hole is cut . . . providing a 90° outlet with full pipe strength. This external rib and the wide base eliminates the need for extra braces to take care of bending and vibrational stresses at the junction. No templets are required for their installation.

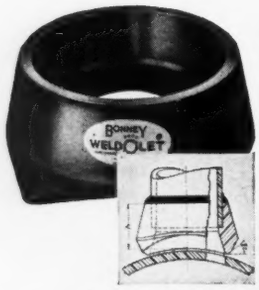


THREDOLET

Their ease of installation and low first cost make them the ideal fitting to use in making right-angle welded branch pipe outlets. Available for all standard pipe sizes and for all commonly used pressures and temperatures, they belong in every welded piping system.



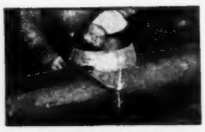
WeldOlets, ThredOlets and Socket-End WeldOlets make it possible to take branches off close together. Cutting, threading and fitting of the main pipe is eliminated.



Socket-End WELDOLET

Your local distributor will be glad to give you the full story of WeldOlets, ThredOlets and Socket-End WeldOlets or write for Bulletin WT29—TODAY.

EASILY INSTALLED



Mark center lines and tack the fitting into place.

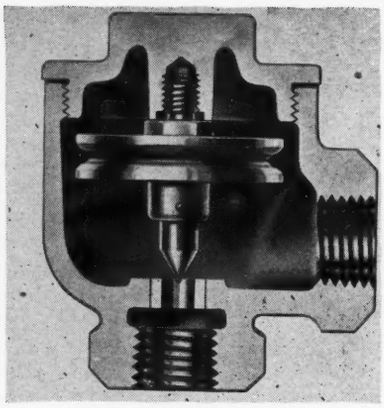
Then weld the fitting to the main pipe.

Remove the button, which will also permit inspection of the inside of joint.

Then attach the branch pipe.

Bulletin WT29—20 pages packed with information and data on advantages of WeldOlets, ThredOlets and Socket-End WeldOlets. Write for your copy NOW.

BONNEY FORGE & TOOL WORKS
FORGED FITTINGS DIVISION
ALLENTOWN, PA.



and ¾ in. for 700 sq ft. "Old Ironsides" valves are limited to two sizes—¾ in. and 1 in., both in angle body with wheel handle standard. *Warren Webster & Co., Camden, N. J.*

Resurfacer

STONHARD STONPACH develops strength so rapidly that it can be used where time is an important element, where the closing to traffic of any area for more than a few hours is undesirable. Produces a sturdy floor, one that is smooth, skid-proof and easy to clean, capable of withstanding heavy traffic. It is light grey in color, approximately the same as ordinary cement, but is unaffected, according to maker, by causes of dusting, pitting, and raveling. No admixture required and no special equipment needed for its use. *Stonhard Company, 410 North Broad Street, Philadelphia, Pa.*

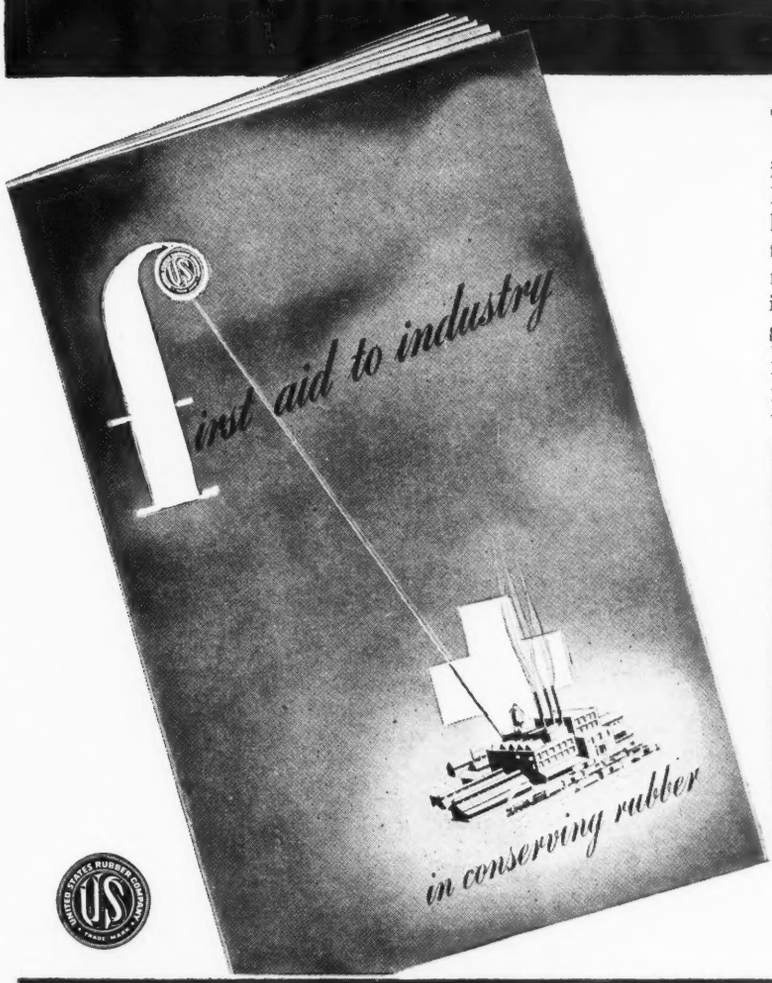
Arc-Welding Electrode

W-26 ELECTRODE fulfills need for vertical and overhead ac welding electrode that will give a high quality job from standpoint of physical characteristics as well as easy operation, adequate penetration, and practically flat fillet contour. Electrode is now available in diameters of ⅛ and $\frac{5}{32}$ in. Other sizes from $\frac{1}{16}$ to ¼ in. expected to be available shortly. *General Electric Company, Schenectady, N. Y.*

Interlocked Engine-Room Grating

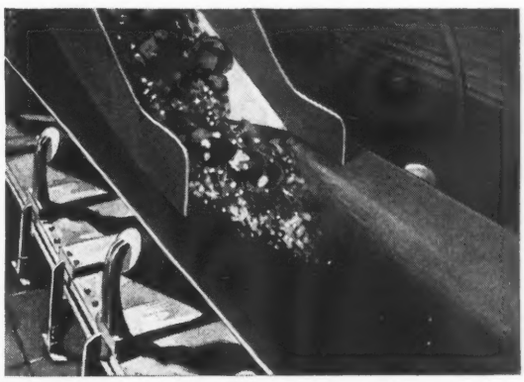
LIGHT-WEIGHT self-supporting panels are of perforated metal to take 24- or 30-in. spans and to lay 12- or 24-in. centers. Panels are perforated with holes ⅞ in. in diameter, large enough to permit light and ventilation but not large enough to let tools or small engine parts drop through. Can be fitted as easily as checkered floor plate, but weigh less than half as much, said to give a better foothold and do not set up a drumming noise when installed

HOW TO HELP YOUR PLANT IN THIS RUBBER CRISIS



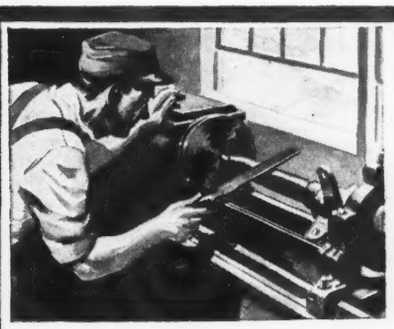
THIS NEW 48-PAGE BOOKLET

is for managers, engineers and plant operating men. It shows how to conserve rubber through proper handling, installation and care by methods such as those illustrated below. Other subjects covered are molded goods, rubber covered rolls, rubber mountings, rubber printing materials, mats and matting, grinding wheels, electrical wires, cables and tapes. Free copies will be sent on request. Write the Mechanical Goods Division, Dept. 19, United States Rubber Company, at address below.



Protect Conveyor Belts by using "V"-shape notch in loading chute to distribute fine material first as cushion for heavy lumps.

Conserve Hose by proper choice and installation of couplings to assure application without injury to hose tube.



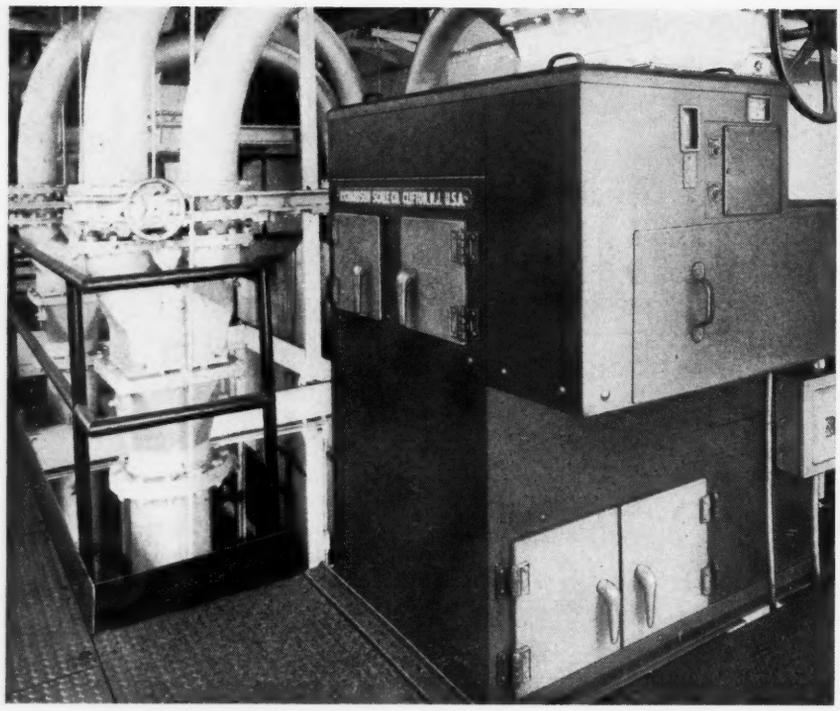
Extend Packing Life by examination of equipment, and reconditioning worn moving parts before repacking.

Preserve Rubber Linings from danger due to "changed over" operations, higher temperatures and possible damaging effects of substitute materials.

UNITED STATES RUBBER COMPANY

1230 Sixth Avenue · Rockefeller Center · New York

In Canada: Dominion Rubber Co., Ltd., Toronto, Ont.



RICHARDSON COAL SCALES GIVE
ROCK HILL PRINTING & FINISHING CO.

More power from every ton of coal!

• In peace economy means profit. Now, more important, economy means more production.

Here in the Rock Hill Printing & Finishing Co., at Rock Hill, South Carolina, five Richardson Coal Scales increase production by keeping a constant and unfailing check on coal consumption.

In average installations, users report Richardson Coal Scales help to increase steam production from 5 to 10% because of accurate records of coal consumed by each boiler, enabling operators to keep boilers operating at maximum efficiently continuously.

You too can get increased production and efficiency from your boilers with Richardson equipment. Do it now.

Let us show you how.

RICHARDSON SCALE COMPANY

Clifton, New Jersey
Atlanta Boston Buffalo Chicago Columbus
Minneapolis Montreal New York Omaha
Philadelphia San Francisco Wichita

RICHARDSON

2606

adjacent to diesel engines. *A B Tappen, 71 Nassau St, New York, N.Y.*

Non-Indicating Controller

"TAG" NUMBER 42 has basically the same movement as Tag control, redesigned for compactness in such a fashion that the few simple parts are accessible with ease. Small size does not affect interchangeability of tube systems.

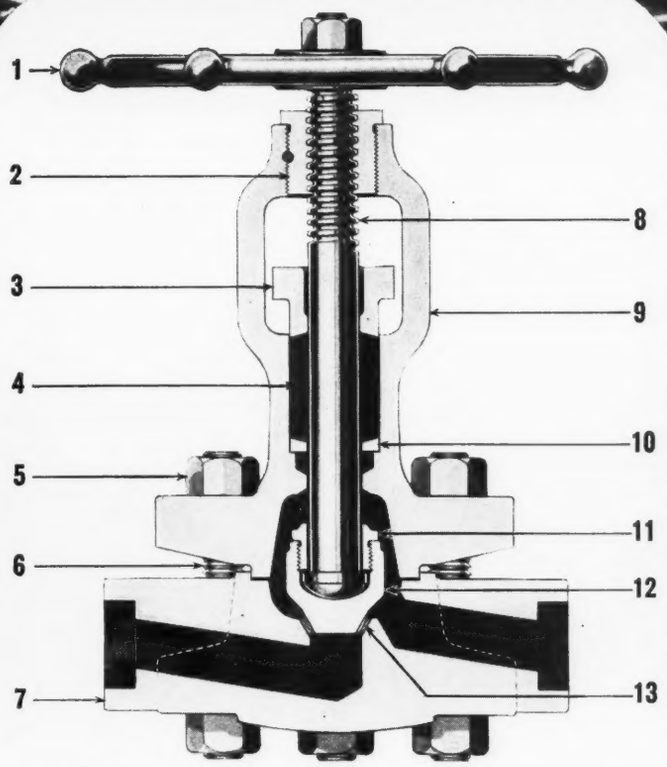
Smallest change in temperature at the bulb is transmitted positively to Tag ball air valve through the novel transmitting spring lever that multiplies movement of capsular spring. Air valve in turn resets rate of flow through diaphragm-actuated control valve in steam line. *C J Tagliabue Mfg Co, Park & Nostrand Ave, Brooklyn, N.Y.*

Dual-Purpose Pumping Unit

COMBINATION ROTARY-CENTRIFUGAL dual pumping unit has been added to company's line. New unit is mounted on a cast bedplate and is powered by a 4-hp, 3-phase, 60-cycle motor with gearhead on one end to drive rotary pumping unit, and a shaft extension on the other end, direct-connected to a centrifugal pump. Rotary unit has a capacity of 44 gpm at 50 psi, handling lube or fuel oil, while the centrifugal unit has a 75 gpm capacity at 25 psi handling water. *Blackmer Pump Company, Grand Rapids, Mich.*

Leak Sealer

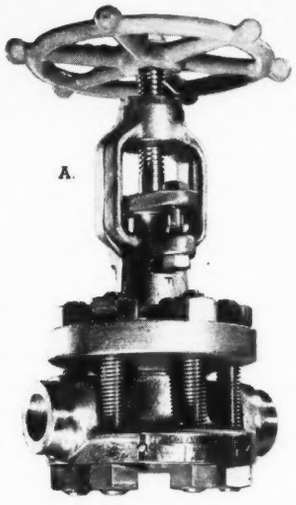
COLORLESS LIQUID leak sealer offers quick way to stop leaks in concrete walls, tunnels, floors, tanks and pits. Procedure is to mix liquid chemical with ordinary portland cement, mold into a "carrot" and force it into opening. Where dampness or seepage exists, apply plaster coat of same material to make surface dry. *Flexrock Company, 2300 Manning St, Philadelphia, Pa.*



13 UNIQUE DESIGN FEATURES

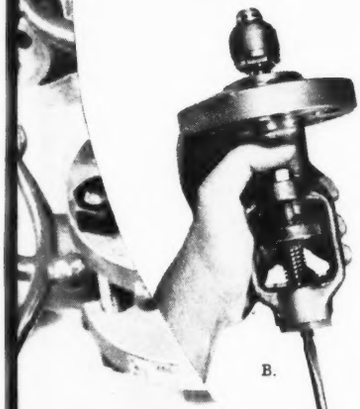
Cut Operating Interruptions

LENGTHEN USEFUL VALVE LIFE



A.

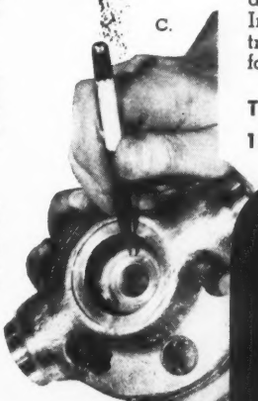
1. Handwheel—malleable iron, oversize and knobbed for easy operation.
2. Yoke bushing—cast bronze, replaceable. Extra length threading minimizes wear, prevents galling.
3. Gland—drop forged steel, through bolted, accurately guided.
4. Packing—braided asbestos, wire inserted jacket with plastic core.
5. Bonnet nuts—easily accessible ASA heavy nuts.
6. Bonnet studs—fully threaded, air cooled, equal length for evenly-stressed tight bonnet joint.
7. Body—forged carbon-molybdenum steel (cast for 2 in. Fig. 5264). Metal distribution equalized to make distortion in heating and cooling negligible.
8. Stem—heat treated and ground EValloy (stainless steel).
9. Bonnet—carbon-molybdenum steel. Deep stuffing box and cooling chamber prolong packing life.
10. Junk ring—hardened, accurately gaged and fitted.
11. Disk nut—finely finished heat treated stainless steel. Pressure tight joint permits leakproof backseating.
12. Disk—alloy steel with heavy layer of ground and lapped Stellite on wide contact face. Balanced symmetry and correct clearances prevent wear in service.
13. Seat—continuous ring of Stellite, integral with body. Perfect alignment with working parts.



B.

A. Ready for hard work. Edward Intex globe stop valve Fig. 2264, socket ends, for 1500 lb, 950 F service. Note simple, sturdy construction.

B. No special tools needed for disassembly. Screw driver in slotted stem square makes it easy to assemble or remove stem and disk assembly.



C.

C. Wear-resisting Stellite seat is part of body in Intex valves. This means greater protection against corrosion and erosion, fewer interruptions, less maintenance, longer life.

EXTRA PROTECTION against costly operating interruptions, easier maintenance, extra life, and greater fitness for tough service are built into Edward Intex* valves in 13 different ways.

From the integral Stellite seat, which forever eliminates the possibility of leakage between the seat and body under high operating temperatures, to the easy-to-operate handwheel, every one of the 13 principal parts of Edward Intex valves have been designed for maximum operating efficiency under severe service conditions.

Like the integral seat, the contact face of the perfectly proportioned disk is generously faced with erosion-resisting Stellite. Valve ports are designed to give the least possible resistance to flow consistent with quick, positive cut-off.

Maintenance, though seldom necessary, is unusually simple. No special tools are needed for disassembly, and working parts are easily accessible.

Available in socket welding, screwed or flanged ends from ½ to 2 in., Intex valves are rated at 1500 lb sp at 950 F, but are equally trouble-free and economical in intermediate service.

*Reg. U.S. Patent Office.

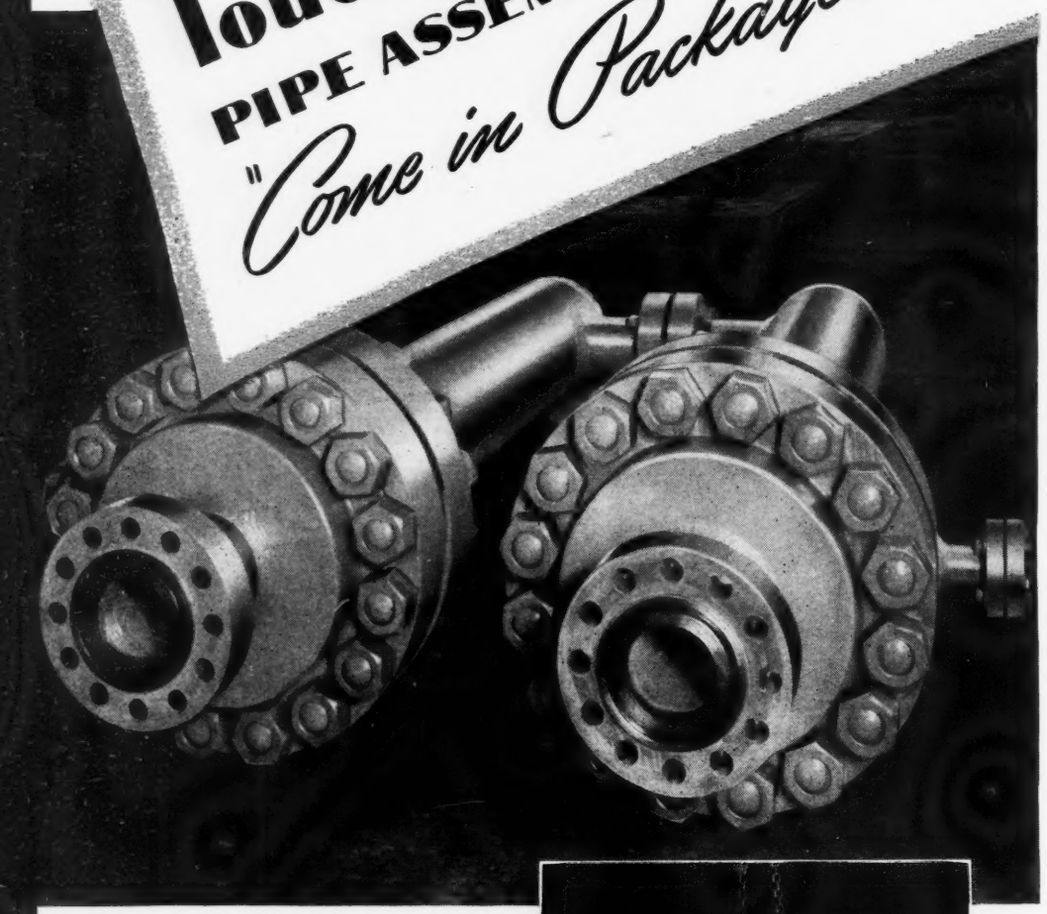
Bulletin No. 12-G5 describes in detail the advantages of the smaller size Edward Intex valves. Full dimensional data, illustrations and material specifications. Write for your copy today!

THE EDWARD VALVE & MFG. CO., INC.

1220 West 144th Street, East Chicago, Ind.

EDWARD *Steel* CAST AND FORGED VALVES

TOUGHEST PIPE ASSEMBLIES "Come in Packages"!

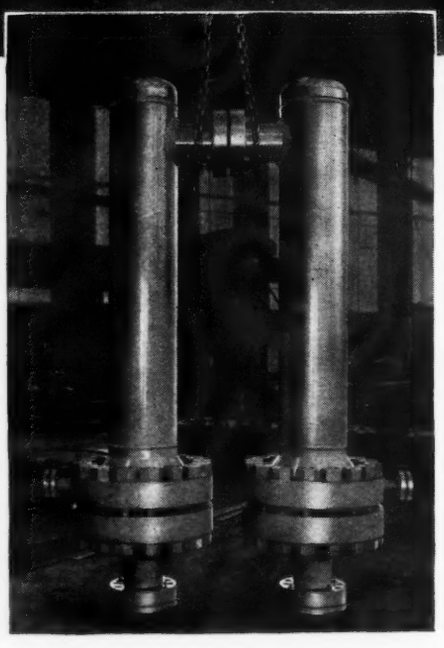


*High-pressure sub-assemblies like this are delivered to installation sites, **underwriter-approved.***

Your new power-piping installations can be obtained with no more difficulty or personal attention than any *factory-made* item of major equipment!

Prefabrication by Grinnell takes over all the tough fabrication work . . . performs it better and faster . . . delivers the complete job in convenient "packages" consisting of sub-assemblies ready for immediate field hook-up!

"Give the Plans to Grinnell" when your piping requirements are roughed out. Grinnell engineers are equipped by long experience to interpret power and processing layouts into super-piping systems. Grinnell plants, strategically located to serve war industries, have every last facility to prefabricate simple and complex sub-assemblies . . . accurately, efficiently, in least time.



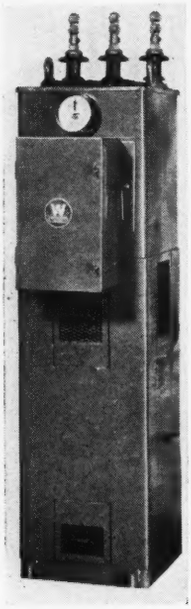
Get the complete story of this detail-saving service. Write for photo-facts booklet, "Grinnell Piping Prefabrication". Grinnell Company, Inc., Executive Offices, Providence, R. I. Branch offices in principal cities.

PREFABRICATED PIPING BY GRINNELL

WHENEVER PIPING IS INVOLVED

Voltage Regulator

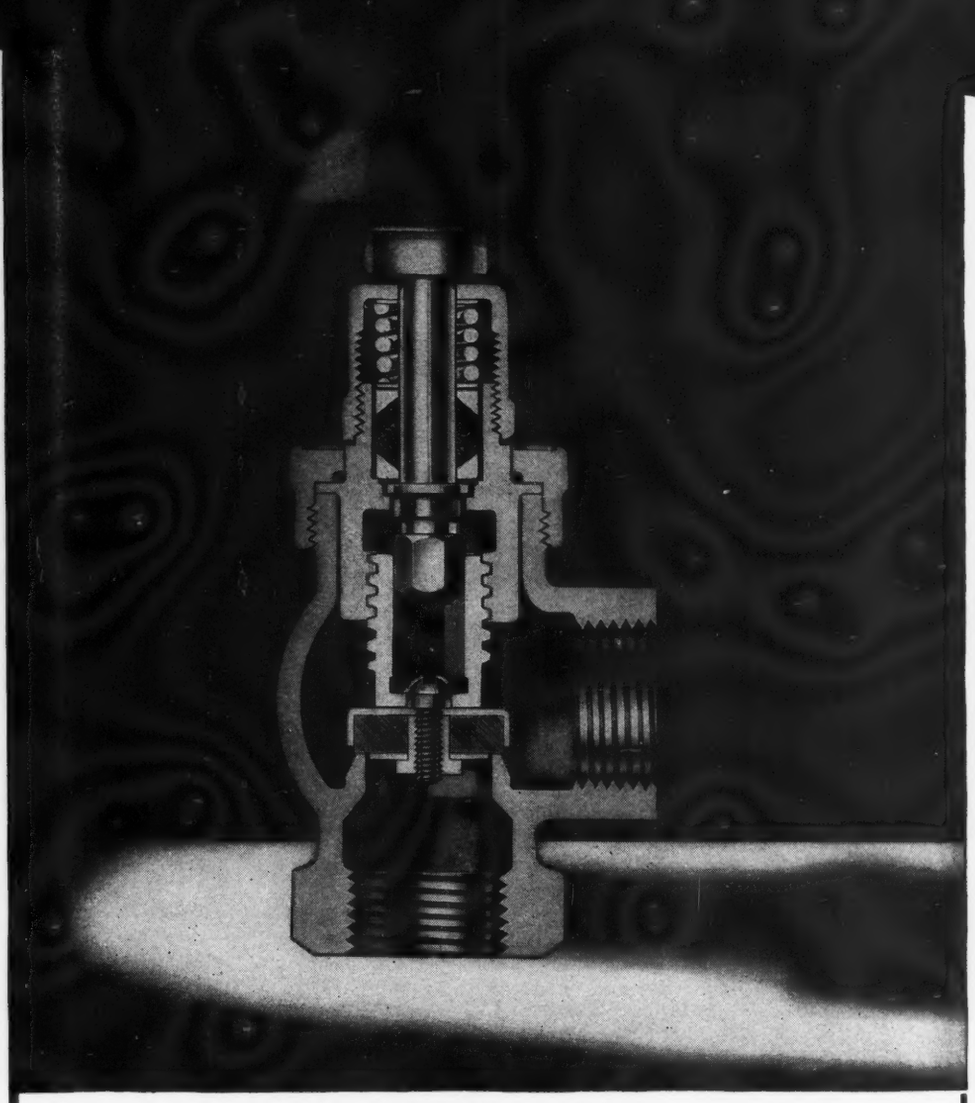
VOLTAGE REGULATOR especially designed for feeder circuits where exacting voltage regulation requirements must be met and liquid cooling is undesirable. Known as type SA, regulator is intended for single-phase feeders, 2,400 volts, 50 to 300 amp and 4800 volts, 25 to 150 amp. Single-phase units can be used in banks on polyphase circuits two units in open delta an 2400 or 4800



volt 3-wire circuits or three 2400-volt units on 4160 volt 4-wire circuits. All ratings have self-contained power for motor and other control functions. No liquid cooling is required, and winding insulation is flame resisting to reduce hazard from fire or electrical failure. For low maintenance and continuity of service, a new design of voltage regulating relay eliminates usual assembly of delicate pivots, pins, and springs. Separate transformers prevent operation of the motor from affecting the relay. *Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Portable Pumping Unit

PORTABLE PUMPING UNIT which may be adapted to a variety of services, municipal and otherwise, consists of 2-in. nonclogging F-M sludge pump, direct connected to a 3-hp F-M splashproof motor, mounted on standard warehouse truck with 8-in. rubber-tired wheels. Pump is primed by hand operated bracket-type pump mounted on truck platform with suction connected to volute top through a ¾-in. pipeline equipped with shut-off valve. Sludge is picked up through a wire-lined rubber suction hose and discharged through a collapsible cotton hose, fitted with gate valve



Webster ¾" 603PHF Radiator Valve

Designed for War-Time

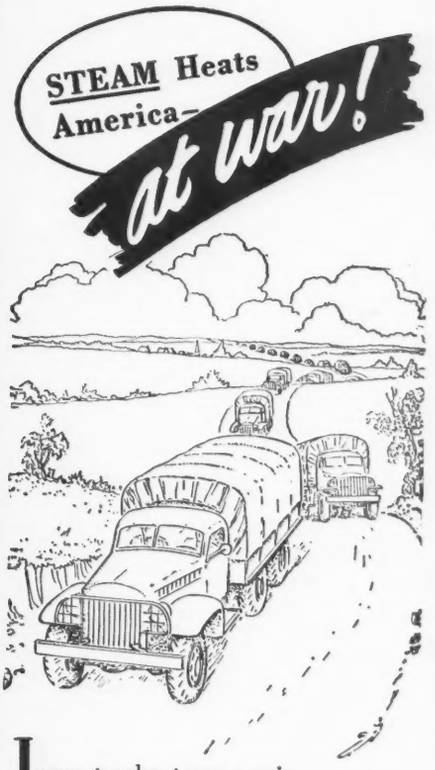
Iron Radiator Valves

The "Old Ironsides" line of Webster Radiator Valves and Traps complies fully with the conservation and simplification program of the War Production Board. Cast iron bodies and bonnets release critical brass; unionless female inlet and outlet connections contribute metal and machine-tool hours to the Victory Program. This all-out conservation helps keep steam available for its important heating role in war-time . . . "Old Ironsides" Valves in two sizes—¾" and 1"—angle body with wheel handle. Construction is a proven Webster design, meeting "spring packless" specification—a heavy spring pressing on die-molded metallic ring packing. Non-rising stem. Quick opening . . . "Old Ironsides" Traps in three sizes—½" for 200 sq. ft.; ¾" for 400 sq. ft.; ¾" for 700 sq. ft. Traps employ time-tested Webster thermostatic element, a double diaphragm of phosphor bronze fully compensated for pressure . . . "Old Ironsides" Valves and Traps are available on appropriate priority.

Keep your present Webster Equipment in first-class condition—add years of life to your heating system—by following the practical heating advice in Webster Service Bulletin S-500-E. A copy is yours for the asking.

WARREN WEBSTER & COMPANY

CAMDEN, N. J., EST. 1888, PIONEERS OF VACUUM STEAM HEATING



Jeeps, trucks, troop carriers . . .

Half tracks, mobile machine shops . . .

Transportation and supply for an Army of three, six, ten million men . . .

That is America's promise to the Victory Program—and America is going to beat that promise.

It calls for miles and miles of added production space.

New buildings to be heated—evenly, economically. New plants—requiring the finest heating America can provide.

For fifty years, America's best heated buildings have used steam as a heating medium . . . steam harnessed and brought under control with Webster Systems of Steam Heating.

Today, the experience of the Webster Organization in the heating of 75,000 buildings is offered to Army, Navy, Marine Corps . . . and to architects, engineers, and heating contractors working on war construction.

While Ordnance production has first call on our facilities, we are still producing Webster Steam Heating Equipment for use in the war effort.

Essential repairs for Webster Systems are available on A-10 priority, under W.P.B. Emergency Repair Order P-84. Orders should be limited to actual needs.

Warren Webster & Company, Camden, N. J.
Representatives in 65 principal Cities

Webster
Steam Heating

This is one of a series of advertisements that will tell the public of the part that Webster Steam Heating and the Webster organization plays in the war effort . . . appearing regularly in leading business, industrial, engineering and technical publications.

THE UNSHAKO SELF-LOCKING NUT
REALLY "STAYS PUT"

Pat'd and Pat's Pend-ing Cutout section showing locking ring in place.

—regardless of vibration. The locking-ring is always on guard . . . automatically prevents backing-off . . . Saves maintenance time and breakdown trouble . . . yet . . . can be readily backed off with a wrench . . . and, it can be used again and again. Write for complete details.

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNA. BOX 577
— BRANCHES —
BOSTON • DETROIT • INDIANAPOLIS • CHICAGO • ST. LOUIS • SAN FRANCISCO

NOW I CAN'T FORGET
to note the water level

Put a PYREX Broad Red Line Gauge Glass in any boiler room, and the water level of your boilers becomes the center of attention. The transparent broad red line fused directly to the wall of the gauge glass is a far better reminder to the engineer than a string around his finger.

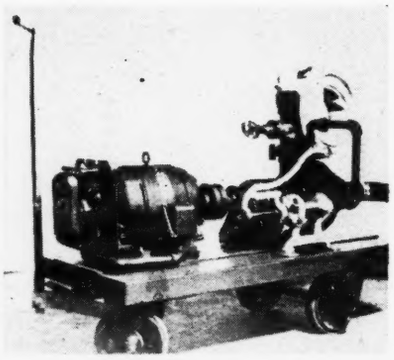
The resistance of PYREX brand Gauge Glasses to the corrosive action of steam insures a longer life of high level visibility. Their machine drawn accuracy, their ability to withstand maximum working pressures, and their remarkable resistance to thermal shock make that life a more useful and economical one.

PYREX Broad Red Line, PYREX Red Line, PYREX High Pressure and Corning Standard Gauge Glasses, for every requirement, are stocked by leading mill and steam supply dealers.

Left, a reproduction from an actual unretouched color photograph which illustrates the appearance of the gauge glass from directly in front.

"PYREX" *is a registered trade-mark and indicates manufacture by Corning Glass Works, Corning, N. Y.*

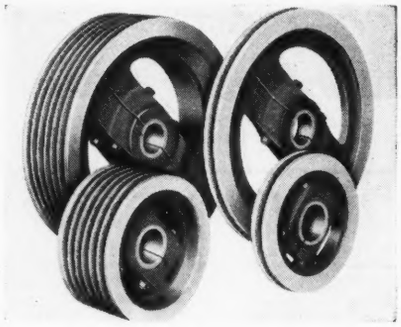
CORNING Glass Works Corning, New York
Pyrex Gauge Glasses



to control head under high-suction-lift conditions and to seal pump discharge during priming operations. Unit is used on construction projects, at any place where temporary drainage is necessary and wherever a portable pump is required. *Fairbanks, Morse & Co, 600 S Michigan Ave, Chicago, Ill.*

Wood Sheave

WOOD SHEAVE FOR V-BELT DRIVES is offered as an alternate for metal sheaves. Efficiency of this sheave is equal in every way to that of metal sheaves except where flywheel effect is



essential. It is of laminated construction and segments are selected straight-grain kiln-dried hard maple. Wood bushings are provided and provision is made for firm fastening to shaft. *Dodge Mfg Corp, Mishawaka, Ind.*

Induction Motors

NEW LINE OF POLYPHASE INDUCTION MOTORS, in sizes from 1 to 20-hp, NEMA frames 203 to 326 inclusive, are suitable for use under hazardous magnesium-dust conditions in rapidly growing number of magnesium-handling plants. These motors are totally enclosed, with non-ventilated construction in smaller ratings and fan-cooled construction above 2 hp. Simple cast-iron end shields, stator frames, and fan housings make dust-tightness possible without complicating assembly and disassembly. Other features include non-sparking bronze external fans, relatively straight and smooth external ventilating passages (for fan-cooled motors) to facilitate cleaning, permanently sealed-in

BULLETIN BOARD

WPB PRODUCTION DRIVE

STEP UP PLANT EFFICIENCY BY—

1 TAKING CARE OF TOOLS
2 PREVENTING BREAKDOWNS
3 CUTTING DOWN ACCIDENTS
4 GOOD LIGHTING
5 MAINTENANCE AND REPAIR
6 ADAPTING OLD MACHINES TO NEW USES
7 CUTTING WASTAGE
8 BREAKING PRODUCTION BOTTLENECKS
9 USING EVERY MACHINE TO THE FULLEST EXTENT

Five of the nine suggestions for "Increasing Plant Efficiency" in WPB's PRODUCTION DRIVE include problems in which Standard Lubrication Engineers can give you valuable help. For instance:

7 CUTTING WASTAGE

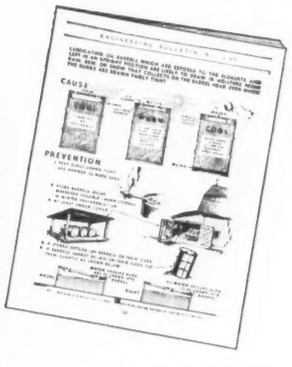
• CUTTING WASTAGE of oil is important. But cutting wastage caused by poor lubrication is one of today's most serious problems.

There's where a Standard Oil Engineer can be of real help to you. He can locate hidden waste that you might overlook in the press of other problems. Here are some of them:

- Excessive power consumption on conveyors, reduction gears, etc., caused by wrong lubricants.
- High labor costs for cleaning gear cases, oil circulating and hydraulic systems.
- Lost production time from unnecessary shutdowns for cleaning.
- Damaged equipment caused by the use of the wrong lubricant through inefficient lubricant handling methods.

There are many more ways that wastage can slow down your drive for production. Let a Standard Lubrication Engineer help you find them. Take advantage of his recent experience on problems just like yours.

HOW TO PREVENT WASTE IN HANDLING LUBRICANTS



The Engineering Bulletin, "Storage and Handling of Lubricants," may have a few timely suggestions for you to help prevent wastage caused by contamination of lubricants in your plant. It will be particularly helpful to new men in charge of lubrication. A copy will be sent you without obligation. Just write Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago, Illinois.

OIL IS AMMUNITION...USE IT WISELY

Copr. 1942, Standard Oil Company

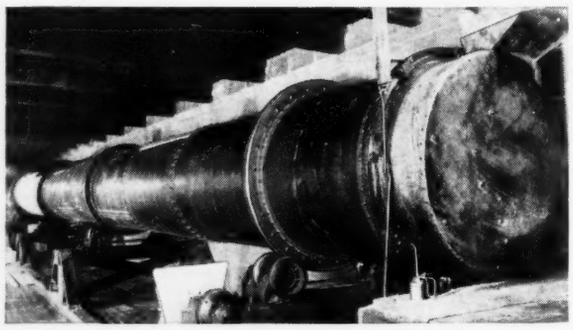
STANDARD OIL COMPANY (INDIANA)

LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENG

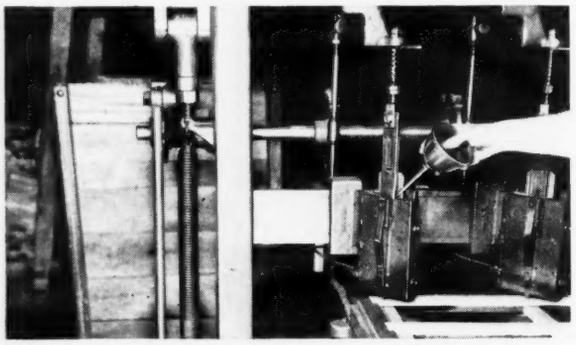
NG • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICAT

STANODRIP CUTS WASTE AND WEAR ON ALL THESE MACHINES

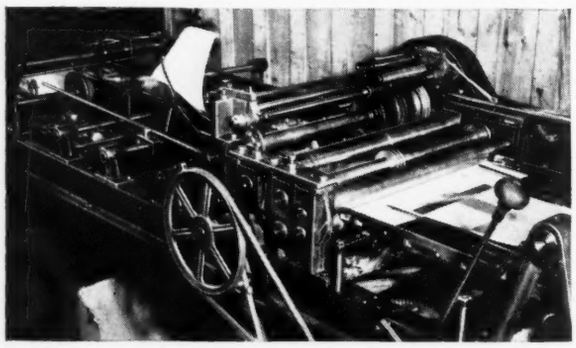
BEFORE redesigning or replacing leaky bearings, try Stanodrip on them. See if it doesn't eliminate the waste, damage to products, and dangerous oil spots around equipment as it did on the machines shown below.



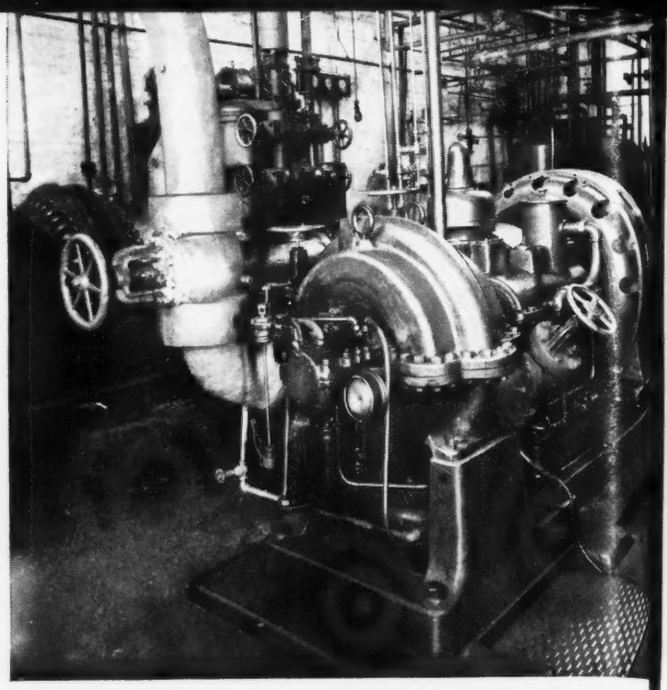
Bearings and slip ring on this toothpick polishing machine (above) screeched when lubricated with a straight mineral oil, unless they were flooded. But then oil leaked into the polishing drum and onto the floor. Stanodrip stayed off the floor, out of the drum, and in the bearings.



Sliding shoes on a stapling machine at a Wisconsin box company required a particularly tacky lubricant. A special product—difficult to get—was being used. Stanodrip was tested. With it, consumption was low, wear negligible, and it was easy to obtain.



The problem of stock spoilage on this paper folding machine was also solved with Stanodrip. It eliminated oil creeping along the shafts onto the paper. It reduced power consumption, too, because it stayed in the bearings, and kept them properly lubricated.



KEEP SMALL TURBINES ON THE LINE... LESS CLEANING ...FEWER OIL CHANGES WITH STANOIL

Every minute of generating capacity counts . . . every man-hour of labor is needed . . . every gallon of oil is vital. Cut wastage on all three. Put Stanoil on all turbine-driven auxiliary equipment. Here's an example of the saving you may make.

The turbo-generator, above, in a Michigan plant was shut down every six months to change oil and clean the oil system. Then, in July, 1937, Stanoil was installed. A recent letter from this manufacturer states, "You'll no doubt be pleased to learn that the Stanoil No. 25 which you recommended for our 250 KVA Turbine is still in use and apparently in good condition."

That means five years without a forced shutdown for changing oil . . . without the extra labor for cleaning, and with only a small amount of makeup oil used.

Ask a Standard Lubrication Engineer to tell you more about Stanoil and its application to gear cases, and circulating and hydraulic oil systems.

HERE'S WHERE YOU'LL FIND A STANDARD OIL ENGINEER

Call any local Standard Oil Company (Indiana) office in the middle western states listed below, or 910 South Michigan Avenue, Chicago, Illinois. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

COLORADO • ILLINOIS • INDIANA • IOWA • KANSAS • MICHIGAN
MINNESOTA • MISSOURI • MONTANA • NORTH DAKOTA • WYOMING
SOUTH DAKOTA • WISCONSIN

OIL IS AMMUNITION . . . USE IT WISELY

STANDARD OIL COMPANY (INDIAN

PREVENT SHUTDOWNS

caused by Leaky Valves

A leaky globe or gate valve can be reseated in less than an hour's time without removing it from the line.

Any mechanic using Dexter Equipment can reseat any valve—monel, stainless steel, stellite, brass or bronze—and make the seat and disc or gate absolutely tight and as good as new.

Don't risk a possible shutdown due to leaky valves—cut your maintenance and replacement costs—order a Dexter Valve Reseating Machine today.

Capacities: Globe valves, ¼" to 14"; Gate valves, 1½" to 48"; Pump valves, 1½" to 15".

Send this coupon today

Dexter

Valve Reseating Machines

Leavitt Machine Co., 108 East River St., Orange, Mass.

Send information about Dexter Valve Reseating Machines.

Name .....

Company .....

Address .....

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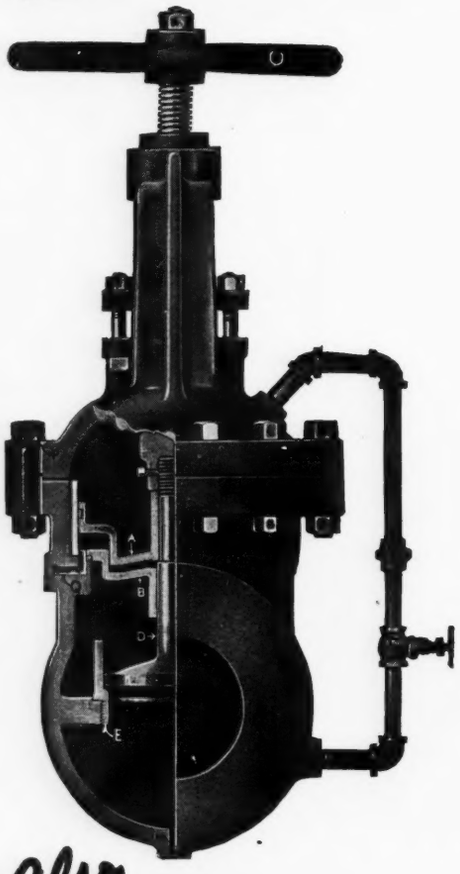
GOLDEN-ANDERSON SPECIALTY Valves



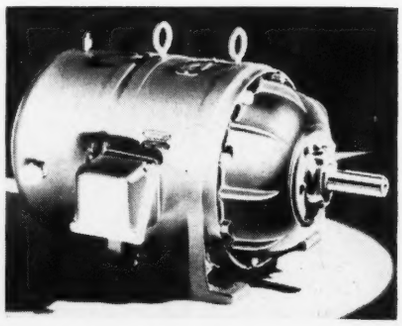
THROTTLE AND EMERGENCY STOP

● With G-A's throttle and emergency stop valve, you're assured of protection against damage to valuable property, for it automatically shuts down any overspeeding engine or turbine. It works instantly . . . mechanically, electrically, or by hand . . . even to being tripped by a push button from remote points. No unit can exceed safe operation speed when equipped with this valve, as maximum speeds are rigidly controlled. Comes in angle and globe patterns from 2½" to 16" in size. You'll find these quality G-A valves in use, under every pressure, on all types of steam engines and turbines. For a more detailed description of the complete G-A line, write for our free catalog today.

Also

Triple Acting Non-Return . . .
Altitude Control . . .
Float Control . . .
Pressure Reducing . . .
Check Valves, etc.

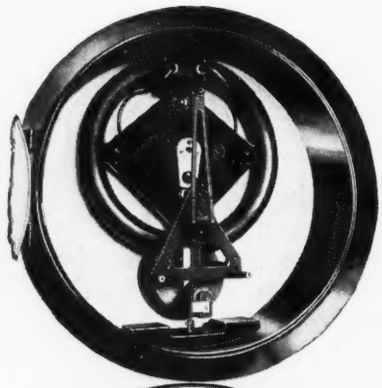
GOLDEN-ANDERSON VALVE SPECIALTY CO.
FULTON BUILDING • • • PITTSBURGH, PA.

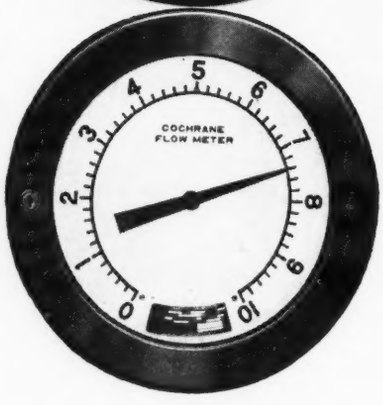


leads, and a rotating labyrinth seal at the shaft opening. *General Electric Co, Schenectady, N. Y.*

Ultra-High-Pressure Flowmeter

A SPECIAL ADAPTATION of the ring balance (tilting U-tube), which has no float, stuffing box or pressure-tight bearing, offers accuracy, freedom from maintenance, and safety for high-pressure flow measurement. Mercury-sealed manometer, stainless-steel ring, is balanced on knife edges. A solid stainless-steel block drilled for pressure connections forms partition at ring top. Nickel tubing connects ring top to rotation center joining free ends of twin 6-in. nickel torsion tubes. Outboard ends of torsion tubes are anchored; pressure lines from primary elements connect to these. The ring tilts 10-deg. for the full differential range measurement (between 4 and 9-in. Hg depending on cam weight supplied). Cam extracts square-root relationship to express flow directly in uniform increments on 36-in.





Tube-Turn Welding Fittings are built to *stand the gaff* at the turns!

FASTER INSTALLATION WITH TUBE-TURN WELDING FITTINGS

In the above assembly, Tube-Turn welding fittings are speeding up the erection schedule and permitting a compactness of piping impossible if handled any other way. Also, their uniform wall thickness makes aligning and welding quicker and easier. Note the five Tube-Turn fittings in this small piping section: (1) a 90° elbow; (2) a tee; (3) another 90° elbow; (4) a lap joint welding nipple; (5) a lap joint flange.

It's tough enough to hang on the board when a speed boat is making sharp turns along a zig-zag course, but add the perilous sport of water jousting—and the *danger at the turns* is doubled!

Extra punishment occurs *at the turns* in industrial piping systems, too. That's why it is safer practice to *weld piping with Tube-Turn fittings.* Tube-Turn fittings provide maximum strength, prevent leakage permanently, and practically eliminate maintenance costs.

There's a Tube-Turn fitting for *every* pipe welding need—the right type, size and weight for every job. Insist on genuine Tube-Turn welding fittings for longer life in your piping.

Send for valuable data book and catalog.

TUBE TURNS, INC., LOUISVILLE, KY. *Branch offices:* New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Tulsa, Houston, Los Angeles, Washington, D. C. *Distributors in all principal cities.*

TUBE-TURN TRADE MARK — The FIRST WELDING FITTINGS 1ST AND STILL THE BEST — *Welding Fittings*

HOW 40 POUNDS OF STEEL METALLIZED IN 7 HOURS

Prevented a Power Blackout!

36,000 POUND SHAFT salvaged at a fraction of replacement cost with 40 pounds of stainless steel sprayed with a MOGUL Gun. In less than a day, this turbine shaft was made like new. Another example of Metallizing's services to industry.

Power engineers can't afford to take chances with costly delays or power blackouts waiting for parts replacement.

That is why MOGUL Metallizing is serving an ever increasing number of power plants. Building up worn shafts, turbine runners, pistons, bearing surfaces, etc., are a few of the many applications of this waste-saving process.

A wide range of metals are available in wire form for metallizing . . . from zinc—which is used on surfaces for the prevention of atmospheric and water corrosion to the hardest of steels, such as chrome and tufton which are recommended for bearing surfaces.

Metallized shafts will wear from 1½ to 3 times as long as original shaft, due to applying harder metal and the slight porosity of sprayed metal—gives the surface better oil retaining characteristics.

MOGUL
FIRST IN THE FIELD

By all standards and shop performance, MOGUL Metallizing will save you time, money and materials. All MOGUL Guns have pistol grip as well as swivel tool post mounting. Lightweight. Rugged construction. Can be operated with propane, acetylene or generated gas. Deposits denser, finer coatings, which are easily machinable.

Write today for catalog and price. Our factory-trained sales engineers will gladly assist you to help "Keep 'Em Rolling."

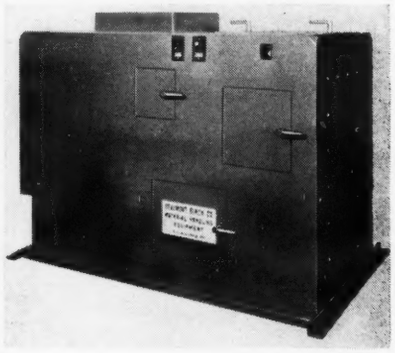
MOGUL

METALLIZING COMPANY OF AMERICA
1331 WEST CONGRESS STREET *Chicago*

indicating scale which may also be combined with an integrator and/or 12-in. recording chart. *Cochrane Corp, 17th St & Allegheny, Philadelphia, Pa.*

Automatic Weighing Scale

AUTOMATIC WEIGHING SCALE designed for rapid and accurate handling of coal and other free-flowing bulk materials has a vibrating metal feeder deck which conveys the material from feed hopper to weighing hopper, thereby eliminating all rubber belts, pulleys and rotating mechanism. The "Beaumont-Vibro"



automatic weighing scale totally enclosed in dust-tight welded steel case is available in three standard units to handle quantities from 1 to 30 tons per hour. Larger sizes with capacities up to 60 tons per hour can be furnished. *Beaumont Birch Co, Philadelphia, Pa.*

Fire-Extinguishing Chemical

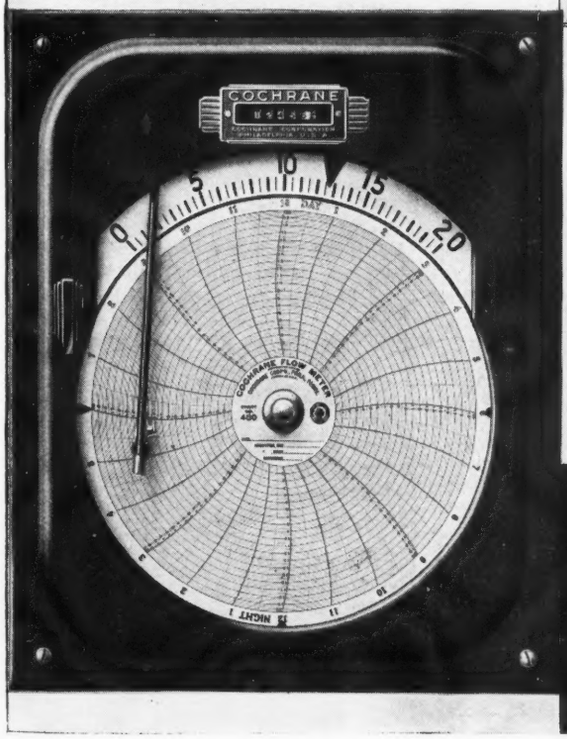
CEND-EX is a granulated coal-tar pitch conforming to the standards set by the U. S. Bureau of Mines for use in extinguishing magnesium bombs and fires. It comes packed in 12½-lb rectangular tubes which can be hung on the wall or placed at strategic points in a factory, ready for instant use. The tube is 30-in. long, enabling the operator to work well away from the bomb or fire. A placard of complete directions is furnished with each tube of Cend-Ex. *S Obermayer Co, 2563 West 18 St, Chicago, Ill.*

Substitutes for Tin-Base Babbitts

TWO NEW LEAD-BASE BEARING METALS known as Pyramid and Defender have been developed as substitutes for tin-base babbitts. Pyramid metals may be applied where bearings must withstand heavy sustained pressures, such as are found in marine reciprocating engines, water turbines, and rolling-mill machinery. Defender metal stands shocks without cracking and is well suited for use in internal-combustion engines,

THE FLOW OF TANKS in this great Tank Arsenal is being recorded in the pages of History

The boiler instrument and control panel board shown at the right is installed in one of our great tank arsenals. Three Cochrane Electric Flow Meters measure steam flow and flue gas temperature. Hays draft gages and controls complete the panel.



THE humble part played by Cochrane Flow Meters in the thousands of power plants that are back of the greatest production drive in history is important because the information furnished by these meters is unfailingly accurate. Cochrane records can be depended on. The reason lies in Cochrane basic design and Cochrane construction. Cochrane design employs the NULL Balance principle, balancing the unknown quantity by adjusting a known quantity of the same kind, a highly sensitive detector being used to determine the point of balance. Friction is eliminated in the transmitter and a powerful external motor drive relieves the measuring circuit of all work. Write for 56-page Publication 3010.

COCHRANE CORPORATION • PHILADELPHIA, PA.

Cochrane
FLOW METERS

The Immediate Solution to Your Flexible Connection Problems!

Type RW-81
(annular corrugations)

Type RW-91
(helical corrugations)

***REX-WELD* (corrugated)**
Flexible METAL Hose

Sizes from ⅛" I. D. to 4" I. D. inc. Pressures to 14,500 p.s.i. Temperatures to 1000° F. One-piece, all-metal construction. Continuous lengths to 50 feet.

Rex-Tite Mechanical (Re-attachable) couplings; solder couplings; brazed and welded couplings and flange assemblies for Rex-Weld Flexible Metal Hose. ***Complete Data on Request***

Use our production capacity to increase your production

CHICAGO METAL HOSE CORPORATION

General Offices: Maywood, Illinois
Factories: Maywood and Elgin, Illinois

trap-rock crushers and sifter machinery. For uniform loads found on pumps and general machinery, the makers recommend Magnolia anti-friction metal. *Magnolia Metal Co, 120 Bayway, Elizabeth, N. J.*

Air-Cooled Arc Welder

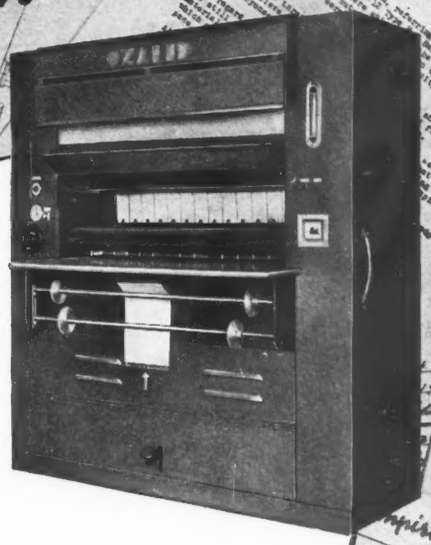
HEAVY-DUTY AIR-COOLED ARC WELDER, known as the 250 F, contains built-in cooling system which reduces thermal stress that strains insulation on ordinary machines and shortens life. Capable of handling an electrode from ⅛

to $\frac{3}{16}$-in., the new model has 24 heat steps, input voltage of 230 and current range of from 15 to 250 amp. Machine operates on 60-cycle frequency and on a single phase or one phase of a two- or three-phase system. Special frequencies may be built to order. *Ergolyte Mfg Co, Philadelphia, Pa.*

Bomb Snatcher

THE BOMB SNATCHER is, in effect, a pair of tongs with semi-cylindrical jaws which enclose the bomb and hold it as

DRY DEVELOPMENT GIVES YOU VERSATILE PRINT MAKING



As the demand increases for faster and faster war production—so the need for dry developed printmaking becomes more and more important. Because dry developed printmaking is ***versatile*** . . . and you are able to quickly make prints of engineering drawings, charts, graphs, letters and maps.

Dry developed prints are made by the Ozalid Process—the direct method of turning out dry, positive-type whiteprints merely by feeding Ozalid sensitized material along with an original drawing into an Ozalid whiteprint machine. In two quick steps—exposure and dry development—the prints are finished!

Here's how versatile the process is: With standard Ozalid materials you get prints having blue, black or maroon lines on a white background, enabling you to assign different color line prints to various departments. Transparent papers, cloth and foils produce intermediate originals which are made just as whiteprints, without additional equipment. All sensitized material comes in either cut sheets or roll stock.

Whiteprints are made with amazing speed — as fast as 20 feet per minute in the largest Ozalid machine. Speeds of other models are geared to suit medium and small reproduction needs. If you are not already using the Ozalid Process, write today for literature describing the many advantages of dry developed printmaking.

SPECIFY **Ozalid** WHITEPRINTS

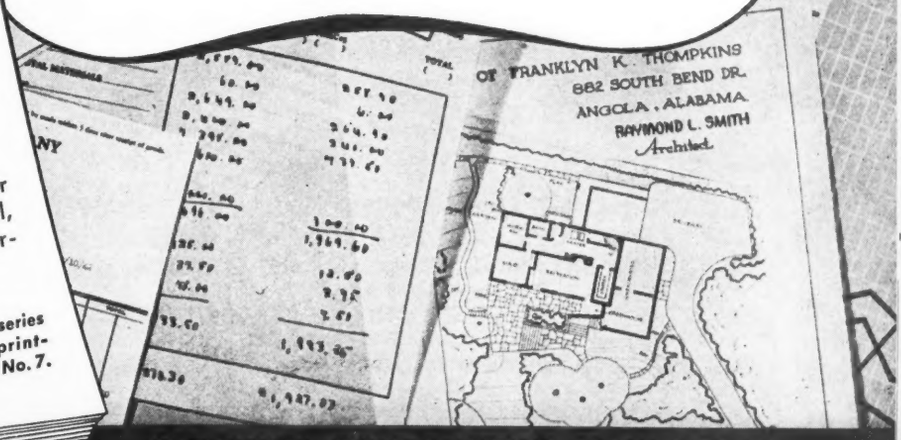
BASIC FACTS ABOUT PRINT MAKING YOU SHOULD KNOW

ALL OZALID WHITEPRINT MACHINES ARE SINGLE COMPACT UNITS, EASILY INSTALLED IN ANY DRAFTING ROOM, PLANT OR OFFICE . . . even the largest machine occupies only 23 square feet of floor space!

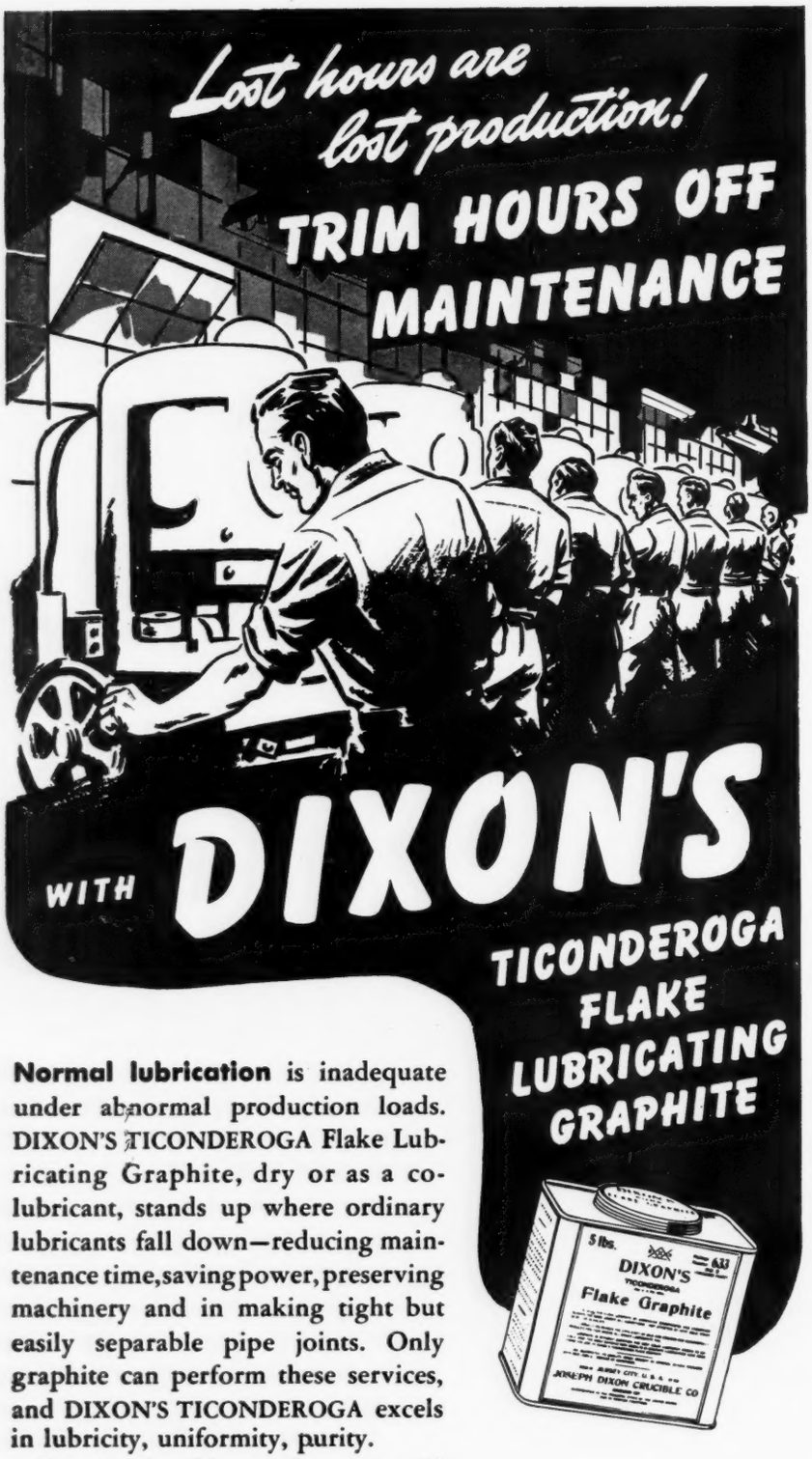
The machines are modern in design—silent in operation—give clean, efficient service. And because dry development is employed, there are no liquid baths . . . no plumbing connections . . . no cumbersome drying equipment.

Ozalid machines are expertly built, able to stand the constant use you would require of them. Their exterior is baked gray enamel, resistant to stains and normal scratches.

This is the sixth of a series of facts on modern printmaking. Watch for Fact No. 7.



OZALID PRODUCTS DIVISION
GENERAL ANILINE & FILM CORPORATION
JOHNSON CITY, N.Y.
Ozalid in Canada · HUGHES OWENS CO. LTD., Montreal



Normal lubrication is inadequate under abnormal production loads. DIXON'S TICONDEROGA Flake Lubricating Graphite, dry or as a co-lubricant, stands up where ordinary lubricants fall down—reducing maintenance time, saving power, preserving machinery and in making tight but easily separable pipe joints. Only graphite can perform these services, and DIXON'S TICONDEROGA excels in lubricity, uniformity, purity.

Dixon's Graphite products are sold by leading industrial distributors.

Ticonderoga No. 1—large, unctuous, lustrous flakes; **No. 2**—finely divided flakes; **No. 635**—minutely subdivided, powdered flakes.

GRAPHITE EXCELLENCE SINCE 1827

JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY, N. J.

Ticonderoga Graphite • No. 635 Graphite • Microfyne Graphite • Pipe Joint Compound

Graphite Seal • Graphited Oils • Cup and Pressure Gun Grease • Gear Lubricants • Waterproof

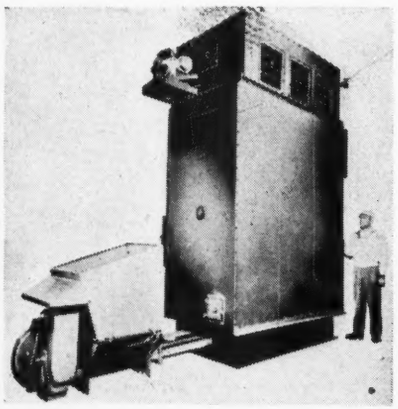
Graphited Grease • Auto-Marine Grease • Graph-Air Guns • Belt Dressing (Contains no Graphite)

2232

in a cup to prevent molten, white-hot magnesium or blazing thermite from dripping out. The jaws are lined with high-temperature fire-resisting material covered with a heat-spreading sheath. Picking up and disposing of bombs causes practically no damage and almost any number may be handled. Should incendiary be of the explosive type, protection is offered to the operator when approaching and removing bomb. *McGraw Electric Co, 5201 West 65th St, Chicago, Ill.*

Coal-Fired Unit Heater

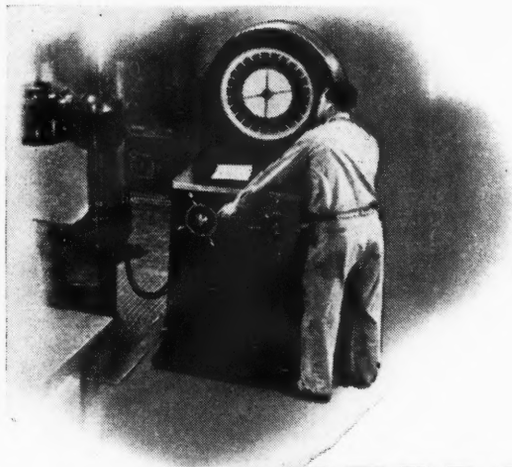
DIRECT-FIRED COAL-BURNING HEATER equipped with underfeed stoker and either hopper or bin feed, also available for hand firing with undergrate fan, is available in eight sizes. Corrugated combustion chamber with unique



fins and deflectors makes possible heat transfer to a moving air stream at about the same rate per sq ft of surface as is obtained in a boiler for transmission of heat from combustion chamber to water. Tightly welded combustion chamber prevents infiltration of excess air. The unit may be installed during construction for temporary heat and retained as a permanent system. *Dravo Corp, Pittsburgh, Pa.*

Displacement-Type Level-Trol

DISPLACEMENT-TYPE LEVEL-TROL features greater sensitivity, speed of action, freedom from service trouble and ease of adjustment. Available in float-cage or internal-float type construction for handling all liquids at all pressures, temperatures and specific gravities. Pilot is 100% pneumatic in operation—all linkage, pivot points and other sources of friction have been eliminated, reducing operating power to an absolute minimum. New features include Inconel torque-tube construction that eliminates stuffing-box packing and lubrication. Level position adjustment permits positive control of level at any desired point



HE READS THE *"Life-lines"* OF GLOBE PRESSURE TUBES

The life expectancy of a Globe Pressure Tube is an open book to the Globe metallurgist. Frequent laboratory tests, including photomicrographic inspection, in addition to careful and thorough individual gauging for wall thickness and outside diameter, insure a consistently uniform quality of product.

Such extra precautions in manufacture may readily be translated into longer life and greater safety in use. This extra margin of safety and strength means lower cost in the long run for the user of Globe Pressure Tubes.

Globe Engineers are always available to assist in selecting a tube with the exact characteristic you require.

GLOBE STEEL TUBES CO., Milwaukee, Wis.

STAINLESS TUBES
BOILER TUBES
CONDENSER AND HEAT EXCHANGER TUBES
MECHANICAL TUBING

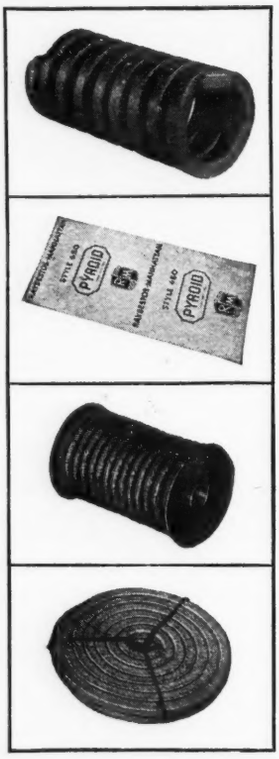
GLOBE STEEL *Tubes*

GLOBE TUBES

Figuratively and literally, the heat is on. Production in America is passing all previous records. This means that steam lines, oil lines, fuel lines, and air lines must take higher pressures for longer periods. R/M packings won't let go, won't let you down. They Hold That Line!

In laboratories and in the field, R/M engineers are testing and re-testing to be sure that these packings can take what all-out production gives. And as a result, R/M packings are giving an even better account of themselves. Rely on R/M!

Do you have a copy of the R/M catalog? It's keyed for applications, illustrated, and indexed as to materials and types. Get a copy of this catalog from your R/M distributor, or write us direct.



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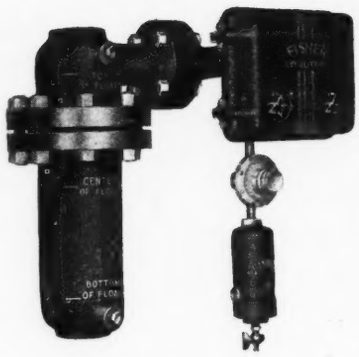
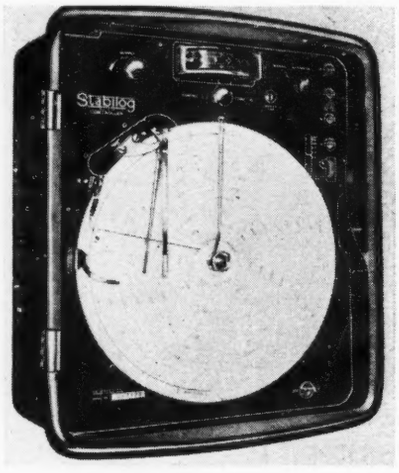
RAYBESTOS-MANHATTAN, INC.
MANHEIM, PA.
BRIDGEPORT, CONN. NORTH CHARLESTON, S. C. PASSAIC, N. J.
Makers of Packings for Every Industrial Use



within length of float while throttling-range adjustment makes it possible to vary amount of change necessary to stroke the diaphragm valve. *Fisher Governor Co, Marshalltown, Iowa*

Stabilizing Control

HYPER-RESET is not an instrument or a mechanism but a control function, available in the newly-designed Model 30 Stabilog controller for application where process-lag is considerable. Hyper-Reset reduces the effects of process disturbance by making initial temporary



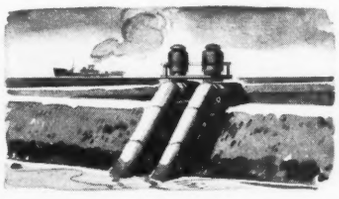
additional corrections, which are proportional to the rates of change of the measured value caused by the disturbance. The normal reset follows, establishing stabilization. The several control functions carried out are simultaneously and automatically adjusted. No more than two process adjustments are required, proportional and Hyper-Reset. *Foxboro Co, Foxboro, Mass.*

Special-Duty Pump Units

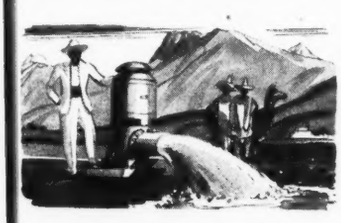
SPECIAL-DUTY PUMP affords small plants and towns adequate fire protection at moderate cost. Unit consists of 4-in. fire pump driven by a 2500 rpm, dc, Ford-Mercury engine which eliminates expense of gear drive, necessary when a slow-speed engine is connected to a high-speed pump. Unit simplicity rep-

A TAP-FULL or a torrent!

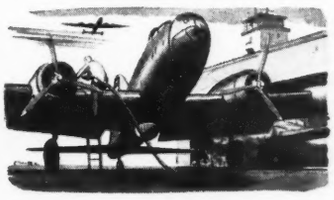
PROJECT contractors selected Peerless Pumps to help build such power and irrigation developments as TVA, Bonneville, Coolidge, Norris, Shasta, Friant and Boulder Dams, and the Los Angeles Aqueduct. Hundreds are in service at other huge projects – the Chicago Subway, at Drydocks, Ordnance Works and for municipalities everywhere.



SALTY sea water is one of America's inexhaustible sources of magnesium. Peerless Hydro-Foil (Propeller Type) Pumps, with capacities up to 100,000 g.p.m., provide magnesium manufacturers with an unfailing water supply. At Panama Canal, in U.S. Flood Control service and at chemical plants other Peerless Hydro-Foils match these spectacular capacities.



GOOD NEIGHBORS. Everywhere abroad, Peerless installations abound. On Mexican haciendas, in Brazil's industries, in Peru's mines, in Cuba's sugar mills, for India's railways, on Hawaiian plantations, in Argentina's municipalities, it's "Peerless Pumps Preferred."



CONTACT. Wartime application of Peerless Pump engineers' knowledge of hydraulics is the successful development and application of Peerless gasoline and fuel oil pumps for direct refueling and transfer service at domestic and foreign bases for aircraft and at docks for ships.

SQUEEZES water uphill is the way owners describe the unique helical action of the chrome rotor pumping element of the Peerless Hi-Lift Pump shown above. A Hi-Lift provides 500 to 3500 gallons of water per hour. Municipalities, dairies, ice plants, laundries and hundreds of industrial concerns find it the answer to low cost, small capacity water supply.

ALLIGATORS are what the U. S. Marines call these amphibian tanks, that are as at home on water as on land. Here, again, Peerless' comprehensive knowledge of hydraulics brought Peerless Engineers the opportunity to do an extra part in the War effort by designing and building amphibian monsters which will speed America's Victory.

PEERLESS PUMPS—PROVIDE WATER FOR MOST EVERY INDUSTRIAL, COMMERCIAL AND DOMESTIC USE

In size, type of drive, choice of lubrication, for any depth or any practicable head, with lasting quality and sustained performance, your safest and most economical investment for lifting water is a Peerless Pump. Peerless Pumps' wide range of capacities can provide from 10 to 100,000 gallons of water per minute – a tap-full or a torrent.

PRE-ENGINEERING AND PRE-TESTING are the bases of customer preference. Peerless engineering and research are continual – results are enduring. Many of the "firsts" in water lifting are Peerless innovations.

SERVICE AND INFORMATION are factors in customer preference. Peerless Distributors are located in every state in the Union and every Allied Nation. Consult your nearest one for pre-sale information, post-sale service.

CUSTOMER PREFERENCE. Evidence of Peerless leadership is the roster of Peerless owners which contains thousands of industrial and commercial concerns whose names and products are household words, the world over. The benefits of the judgment and experience of their engineers are yours when you buy a Peerless Pump.

PEERLESS PUMPS' COMPLETE LINE INCLUDES

Deep Well Turbine Pumps
All forms of drive; electric direct-connected, right angle drive and belted heads.
Hydro-Foil (Propeller Type) Pumps
Hi-Lift Pumps

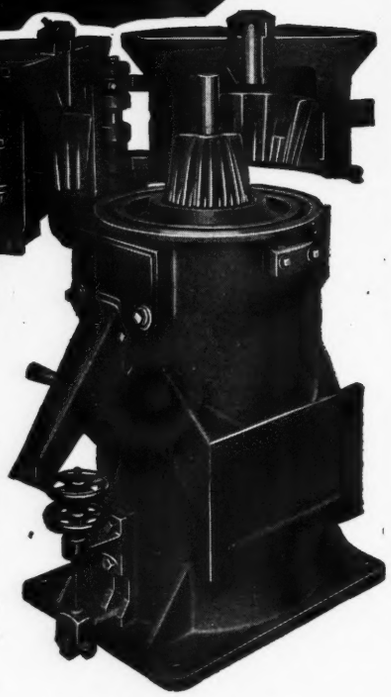
Other Peerless Types
Centrifugal Pumps
Bilge Pumps
Sewage Pumps
Mine Sinker and Mine Dewatering Pumps
Gasoline and Fuel Oil Direct Refueling and Transfer Pumps
Domestic Water Systems and Jet Pumps

BULLETINS are available that illustrate and describe their application. Write for your copies.

Peerless Pumps

PEERLESS PUMP DIVISION — FOOD MACHINERY CORPORATION
1250 CAMDEN AVE., S.W., CANTON, OHIO • 301 WEST AVE. 26, LOS ANGELES, CALIF.
FACTORIES: LOS ANGELES, SAN JOSE AND FRESNO, CALIF., CANTON, OHIO

You'll need to know your B.T.U.'s *in the Coal you buy Tomorrow*



Minimize the chances of interrupted, inefficient plant operation by sampling your coal the "STURTEVANT WAY" . . .

It's as simple as A-B-C to know your BTU's when you sample your coal with the IMPROVED STURTEVANT AUTOMATIC COAL CRUSHER AND SAMPLER—and it's a lot faster and more accurate to get the information you need the "STURTEVANT WAY" than by old fashioned, slow, hand sampling guesswork.

You'll *need* to *know* your BTU's in the coal you get tomorrow because it's likely to be quite different from the kind and quality you're getting today. Heat value, dollar value, performance value may not check with what you've been accustomed to burn in the past—yet you must keep your plant efficiency *up* and the chances of interrupted service *down*.

With Sturtevant sampling you will find the job of adjusting your plant to meet changes in coal characteristics far easier and be in much better position to insure constant operating service. With demand for power ever increasing, you can't risk shut downs.

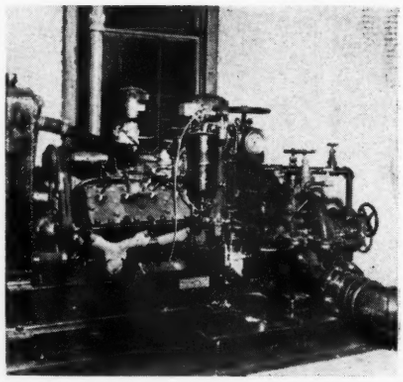
Know what you're buying and pay for what you get . . .

With "Sturtevant" sampling you can buy your coal on a strict B.T.U. basis, avoid paying for impurities, and be assured of accurate heat measurement while eliminating 32 of the 34 operations ordinarily required by hand sampling methods. Actual experience by users discloses outstanding savings in time, money and labor.

INVESTIGATE IMMEDIATELY BY SENDING FOR FREE COPY OF BULLETIN 85

Sturtevant Mill Co.

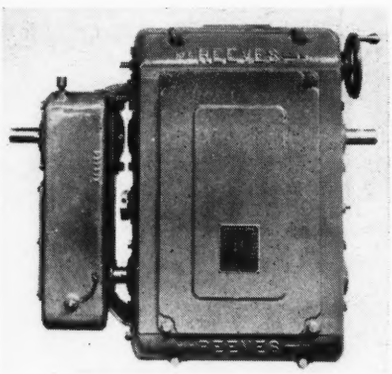
103 Clayton St., Dorchester, Boston, Mass.



resents a saving in installation and maintenance costs over regular fire-pump units. Numerous service stations throughout the country carry stocks of replacement parts for the Ford engine. *Fairbanks, Morse & Co, 600 S Michigan Ave, Chicago, Ill.*

Variable-Speed Reducer

SPECIAL DESIGN of the Reeves variable-speed transmission, enclosed type, is equipped with built-in chain reducer, with output and input shafts in exact alignment. Output speeds may be increased or decreased as compared to



the variable-speed shaft of the transmission and are infinitely variable within predetermined limits by turning the speed-control handwheel. The chain drive operates in an oil bath. The illustrated unit was designed for vertical operation with oil drain and filler located accordingly. *Reeves Pulley Co, 76 Dey St, New York, N. Y.*

Plastic Window Pane

NEW TYPE WINDOW PANE of transparent plastic laminated with wire mesh will withstand explosion of 150-lb bomb 8-ft away. For use in military construction and industrial plants, new material was developed in cooperation with the U. S. Navy to end the menace of flying glass. Tested under vacuum shock conditions, it has stood up without appreciable damage under a 28-in. vacuum. The material consists of standard 16-mesh wire screening sandwiched be-

—AND BUY QUALITY MATERIALS

The use of quality materials is a good guarantee against unnecessary interruptions of top-speed production. That is why Garlock packings and gaskets are in use in so many factories today.

From past experience industry knows it can rely on Garlock quality for the long, dependable service so vital in today's war effort.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Limited, Montreal, Que.

THE STANDARD PACKING OF THE WORLD

Garlock

INSULATION DATA *at Your Finger Tips*

B-H

BALDWIN-HILL INSULATIONS

for Industry

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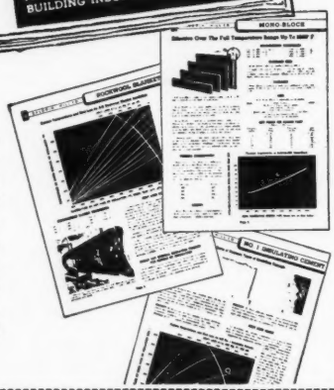
MONO-BLOCK	3
ROCKWOOL BLANKET	4
FILL MATERIAL	6
NO. 100 PIPE COVERING	7
NO. 1 INSULATING CEMENT	10
B-H FELT INSULATION	12
B-H KOLDBOARD	13
WEATHERSEAL	14
MISCELLANEOUS INSULATION	14
BUILDING INSULATION	15



This new 16 page catalog contains complete information on Baldwin-Hill high and low temperature insulations. It includes important engineering and application data, heat loss and conductivity curves, suggested uses and other information that will help you in choosing the correct type, size and thickness of insulation to fit your particular job. *Fill in the coupon and mail it today* to BALDWIN-HILL CO., Trenton, N. J. Branches in New York City, Detroit and Kalamazoo, Mich.

BALDWIN-HILL CO., 575 Klagg Ave., TRENTON, N. J.

Please send me your general catalog as described in POWER

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COMPANY .....

ADDRESS .....

CITY .....STATE .....

tween two sheets of Uelite, Monsanto's transparent cellulose-acetate sheeting originally developed for fluorescent lighting fixtures. It is as clear and transparent as a screened glass window and can be installed easily in any conventional multi-paned, steel or wood sash. Sheets of the laminated plastic can be drawn or formed to almost any desired shape. For economy of manufacture, panels of eight standard sizes are recommended. *Plastics Div, Monsanto Chemical Co, Springfield, Mass.*

Rubber Plastic

NEW RUBBER PLASTIC PRODUCT for conveyor belts, pulleys and other equipment repairs holes and worn spots, making it possible for plant to keep producing without loss of time or replacement of equipment now in service. The material, a putty-like substance, contains only a small proportion of crude rubber; an average repair made with this product on a conveyor belt or on protective clothing such as boots, gloves, or deep-sea diving equipment contains less than 1/48 of an ounce of rubber. *So-Lo Works, Cincinnati, Ohio*

Bomb-Extinguishing Powder

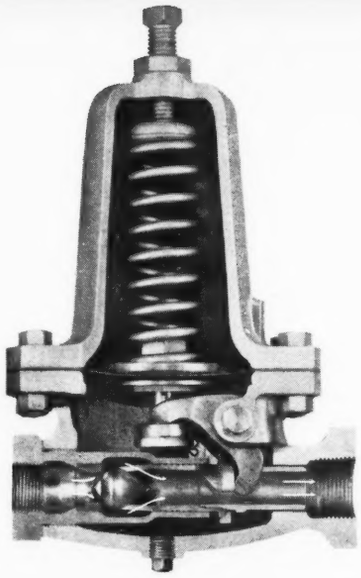
"BOMB-QUENCH" POWDER softens in the heat, flows over the burning mass, clings to it, forms a completely airtight cover that stops combustion quickly, and creates an extinguishing chemical vapor within the insulated crust formed over burning molten metal. Although this chemical forms a solid supporting crust which can be removed from the surface, it is still soft enough to be broken up if desired. This extinguisher comes in a 5-ft long tube and laboratory reports indicate that it is water repellent and retains its free-flowing qualities after being completely submerged in water for two hours. *O H Adams Co, 2018 East Thomas Ave, Milwaukee, Wis.*

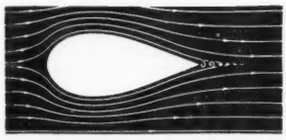
Steel Floodlight

NEW STEEL L-68 FLOODLIGHT offers a choice of three reflectors: (1) a chromium-painted reflector for narrow beams, (2) a painted steel reflector for wider beams, or (3) an internal silvered-glass reflector that is 10 to 35% more efficient than metal-reflecting surfaces. This feature makes the unit applicable for all floodlighting problems. Cast iron is used for socket housing; an asbestos gasket between reflector and housing keeps floodlight completely dry. Door glass is available in plain or

Your CASH STANDARD Streamlined TYPE 1000 PRESSURE REDUCING VALVES

ARE IMPORTANT PARTS OF YOUR PRODUCTION SET-UP *Now* AND ANYTIME





HERE'S THE "1000" FLOW PATTERN
The Streamlined form of the inner valve eliminates turbulence. It produces the flow pattern shown above which makes for maximum capacity when it is needed most and permits accurate pressure control under toughest working conditions.

You can find out full details on all of the Type 1000 benefits by reading Bulletin "1000" —send for it!

Have you forgotten yours too?

Probably you have forgotten that you had CASH STANDARD Streamlined Valves on your lines though it is a number of years since you purchased them. We can assume this because we have often received letters that read in part like this: "The '1000' valves are honeys. The fact that we don't ever have any trouble with the ones we have installed tends to make us forget them."

Good position to be in

When equipment performs so well that it is forgotten, the user is in a good position. Particularly is this true today when speedier production is demanded and the elimination of lost production hours due to "time out" for troubles is essential. So, if you have "1000" valves in your service now, here is one source that is making a valuable contribution to your speed and cost saving efforts.

Inexpensive Renewal Parts

Experience in thousands of installations show that even after long use, only the valve seat and the seat ring show wear. You can make these simple replacements in your own plant — no delays in returning the valve to us. Rehabilitation of the entire valve is thus easily, quickly, and economically accomplished.

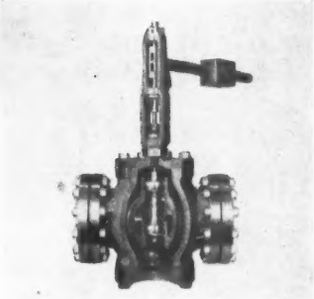
A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD CONTROLS . . VALVES

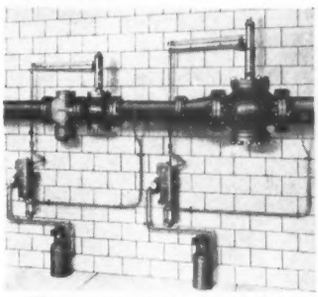
A CASH STANDARD "GET ACQUAINTED" COLUMN

Question: **"Don't you people make anything besides that Streamlined Valve you talk about so much?"**

Answer: **"Yes Sir; we do! And we propose to picture one or two of them here each time."**



For precision jobs — the CASH STANDARD "42-R" Balanced Lever Valve. No lost motion; practically no maintenance. Heavy renewable seat rings; valve stem integral with inner valve. Roller guides kill side strains and stop packing trouble. Comes with parabolic inner valve; flat bevel seat; V-port seat; and V-port non-seating types. Made in sizes ½" to 12" inclusive. For use with pressures up to 600 lbs. Highest temperature 800 deg. F. In iron, bronze, and steel bodies; all standard trims. This valve is made also with center guide, and with Water Cooled, or Air Cooled Packing Box.



Where valve failure would be costly, here are two "42-R" valves operated by CASH STANDARD Type 100 Automatic Controllers, in two-stage pressure reduction. First stage: a 5" Valve reducing 150 to 50 lbs. gauge; second stage: an 8" Valve reducing 50 to 5 lbs. gauge. Load 70,000 lbs. steam per hour. Nearly four years' daily use; not a moment's trouble. (Single stage would have been entirely satisfactory, but customer insisted on double stage reduction.)

Get Free Bulletins on Above . . . Write to
A. W. CASH COMPANY
DECATUR, ILL.

Only Wheelco
UNIVERSAL
Temperature Controllers
can give you:

1. "Electronic Principle" Control, *plus*
2. Extreme accuracy of temperature measurement, *plus*
3. Interchangeability of all component parts, *plus*
4. Interchangeability of scale ranges, *plus*
5. Ready accessibility of all parts for individual checking, *plus*
6. Setting devices which may be mounted and locked within the instrument case as a precaution against sabotage.

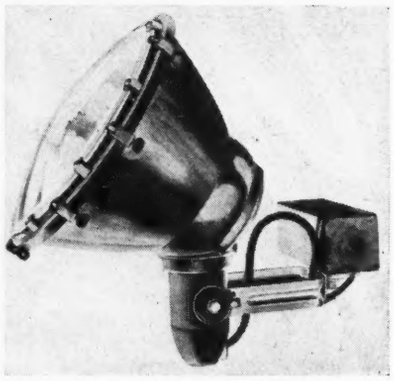
Wheelco UNIVERSAL Controllers include Capacitrols, Potentio-trols, Limitrols and Resistance Thermotrols.

Wheelco UNIVERSAL Controllers have unlimited applications for indicating, measuring and controlling temperatures. For complete information on these instruments write for free bulletin.

This . . .
NEW BULLETIN

—fully describes and illustrates Wheelco Universal Controllers and other Wheelco Instruments. Write, TODAY, for your copy of Bulletin Z6000.

Wheelco Instruments Co.
863 HARRISON STREET • • • CHICAGO, ILLINOIS



stippled convex heat-resisting glass, or floodlight may be operated as an open unit. Accommodates the 750-, 1000-, or 1500-watt general-service lamp. *General Electric Co, Schenectady, N. Y.*

Blackout Bulb

NEW BLACKOUT BULB which can be kept burning for emergency lighting without the need for window shades or blinds, has been approved by the War Department. Bulb gives a faint glow of orange light sufficient to distinguish objects in a room but not enough to be visible from the air even though placed directly in line with an open window. Blackout bulb is coated with an outer covering of black except for an orange-red opening through which a narrow beam of light passes. Operated at 15 watts, each bulb will provide emergency lighting for an area of approximately 200 sq ft. War Department regulations provide that bulbs can be burned only in a downward position and must be kept at least three ft away from doors and windows. *Lamp Div, Westinghouse Electric & Mfg Co, Bloomfield, N. J.*

Protective Coating

RESI-FLEX PROTECTIVE COATING, a transparent resin with an unusual combination of properties for protecting metal, wood, fabric, paper and composition material, may be adjusted to accent one or more of the following properties: dielectric strength; resistance to alkalies, inorganic acids, alcohols, gasoline and oils; flexibility and stretch resistance. Resi-Flex can be used to protect gears and other finished machine parts from corrosion while awaiting assembly or shipment, according to tests conducted by manufacturer. This coating is made in air-drying and baking types which may be brushed or sprayed. The air-drying type is used principally for protecting blueprints, photographs, tracings and manuscripts from fire, stain and water damage. Industrial types are baked at 250-375 F for 6 to 30 min. *David C Brown Co, 17532 Wisconsin, Detroit, Mich.*

NEW CATALOGS, BOOKLETS, BULLETINS

Bring Your Equipment Library up to Date

For Your Convenience

Two reply cards are printed here as a part of this insert. On each is room to request four pieces of literature.

How to Order

1. If you are requesting four pieces or less, use the bottom card. For four to eight pieces use both cards.

2. Be sure to fill out completely one of the eight spaces for each piece you order. This will assure your receiving copies of literature promptly.

3. When you have filled out completely one space for each catalog or bulletin you want, detach along the scored lines and drop the cards in the mail.

Write in circle number of item describing one catalog wanted → (17)

Your Company Name Brown Mfg Co.

Address 3718 First Avenue

Pottsville, Okla.

Your Name John Smith

Your Title Power Engineer

POWER, 330 West 42nd St., New York

These cards not good after October 1, 1942

BOILERS AND ACCESSORIES

1 GAS BURNERS—J O & C U Martin, 637 Minna St, San Francisco, Cal. 6-page folder AIA 30G4 describes Glowan gas burners with photographs and diagrams. Also contains tables of capacities and specifications and typical setting illustrations.

2 OIL BURNING — The Hotstream Heater Co, Combustion Equipment Div, 8007 Grand Ave, Cleveland, Ohio. 4-page manual of information on oil burning contains data and correlative tables covering all factors governing industrial oil-burning problems, with special emphasis on the value of proper draft control.

3 IGNITION SYSTEM—The Engineer Co, 75 West St, New York, N. Y. Bulletin outlines the Enco automatic retractable oil or gas ignition system for lighting-off pulverized coal with remote control. This system also serves as a standby for pulverized coal or other fuel when it is necessary to clear mill or feed pipes, replace fuses, etc.

4 INSULATION—Quigley Co, Inc, 56 West 45th St, New York, N. Y. Bulletin No. 327-F, 8 pages, covers Insulag, a refractory plastic insulating lagging for use on high- or low-temperature equipment. Photographs illustrate uses of product in petroleum industry, metallurgical furnaces, ceramic and power plants.

5 FURNACE DOOR—Plibrico Jointless Firebrick Co, 1800 Kingsbury St, Chicago, Ill. Literature introduces new type of furnace door, for access, inspection and clean-out of boilers, incinerators, etc, which features Lock-tite handle that eliminates excess air around door and thus contributes to combustion efficiency.

6 REFRACTORY CONCRETE — Atlas Lumnite Cement Co, Chrysler Bldg, New York, N. Y. 24-page book features characteristics of Lumnite, methods of making refractory concrete, heat-resistant concrete and refractory-insulating concrete. Book contains many photographs and tables.

7 INSULATING MAGNESIA — Ehret Magnesia Mfg Co, Valley Forge, Pa. File No. 37b discusses physical properties and insulating characteristics of various heat-insulating materials, featuring Ehret's 85% Magnesia. Gives insulating and physical characteristics as well as dimensions and packaging information on various shapes, sizes and forms.

8 REFRACTORIES—Mexico Refractories Co, Mexico, Mo. 8-page bulletin contains information on "Selection of Refractories to Meet Specific Service Conditions," for men in industry who are striving to achieve the ultimate in production to best further the war effort.

9 INSULATION—Baldwin-Hill Co, 575 Klagg Ave, Trenton, N. J. 16-page catalog discusses Baldwin-Hill insulations for industry and shows typical application photographs. Among the types of

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insulation discussed are rockwool blanket, pipe covering, insulating cement, koldboard and weatherseal.

10 STEAM GENERATORS — Union Iron Works, Erie, Pa. 4-page bulletin 27 discusses Union H-type steam generators, self-contained units with steel-cased settings. Details of construction and principles of operation are shown by many photographs and diagrams.

ELECTRICAL EQUIPMENT

11 CAULKING COMPOUND — Johns-Mansville, 22 East 40th St, New York, N. Y. 4-page folder features Duxseal, all-purpose sealing and caulking compound, for sealing duct openings, filling multi-wire contact boxes, protecting battery terminals, and hundreds of other miscellaneous uses.

12 SIGNAL CONTROL—Otis Elevator Co, 260 11th Ave, New York, N. Y. Single sheet B-536 describes signal-control operating panel furnished for signal-control elevators. Normal operation involves only two simple steps on part of attendant.

13 AIR CIRCUIT BREAKERS—Roller-Smith Co, Bethlehem, Pa. 12-page catalog 2150 discusses type HD indoor air circuit breakers for use on ac circuits up to 600 v and dc circuits of 250 or 750 v. Also shows typical ways of making connections to large breakers, gives dimensions of both manual and electrical designs and indicates number and size of terminal for various capacity breakers.

14 RESISTANCE MATERIAL — Keystone Carbon Co, St. Marys, Pa. 4-page folder discusses negative-coefficient resistance material developed to compensate for resistance changes caused by temperature variations, to reduce or eliminate initial current surge in electrical equipment, etc.

15 VOLTAGE REGULATORS—General Electric Co, Schenectady, N. Y. 16-page spiral-bound book entitled "Undervoltage, the Unseen Hindrance to War Production" states that proper voltage is important to war production and that the use of regulators saves copper, man-hours, and cuts installation time.

16 AIR CIRCUIT BREAKERS—General Electric Co, Schenectady, N. Y. 8-page catalog, GEA-2997B, features air circuit breakers for protection of resistance-welding machines up to 600 volts, ac, for installation as overcurrent protection and disconnecting means.

17 CIRCUIT ARRANGEMENTS—General Electric Co, Schenectady, N. Y. 8-page publication, GEA-3759, offers information to help in selection of proper arrangement of load-center distribution systems to fit individual requirements of industrial plants, shipyards, naval and military projects, etc. Bulletin also describes four basic load-center circuit arrangements.

18 ELECTRICAL CONNECTORS — Burndy Engrg Co, 459 East 133rd St, New York, N. Y. Pocket-size catalog, 48 pages, illustrates 75 electrical connector types with catalog listings of important connector sizes. Also contains helpful wiring data.

HEATING, VENTILATING & AIR CONDITIONING

19 REFRIGERATION — Frick Co, Waynesboro, Pa. 16-page bulletin No. 100-C features, with photographs and diagrams, refrigerating machines for food service, air conditioning, marine use, testing and research, cold-storage and process work.

20 UNIT HEATERS—McQuay Inc, 1600 Broadway, N E, Minneapolis, Minn. 12-page bulletin No. 770 features McQuay unit heaters for diesel-engine heat recovery which transfer the heat from the jacket water to the air in occupied rooms and offices, produce correct temperature conditions during heating season and provide for proper engine cooling all year.

21 FANS — Kontrol-Fans, Inc, 4031 Goodwin Ave, Los Angeles, Cal. New bulletin, 4 pages, features Kontrol-Fans with thermostatically operated controllable-pitch blades for use in stationary power units, trucks, buses, compressors, cooling towers and all fan-cooled prime movers.

22 BLOWERS — Roots - Connersville Blower Corp, Connersville, Ind. 20-page bulletin No. 22-23-B-11 discusses and illustrates rotary positive-displacement blowers, their operating principles, design and construction features, for use in sewage-treatment plants, water works, in chemical process industries, in pneumatic-conveying systems, and in varied applications throughout many industries.

LUBRICATION

23 LUBRICATION—Sun Oil Co, 1608 Walnut St, Philadelphia, Pa. 16-page book entitled "Helping Industry Help America" contains case histories which show how engineering service in applying petroleum products in metal working, general lubrication, processing, mining, textile manufacturing and other operations is increasing American production.

24 OIL PURIFICATION—Honan-Crane Corp, 200 Superior St, Lebanon, Ind. 81 page publication entitled "On Land and On Sea" furnishes data on oil-purification installations in industry. Contents cover diesel engines, turbines, hydro-electric generators, and a wide range of industrial uses such as hydraulic presses, transformers, cutting and grinding machines, etc.

25 AUTOMATIC CLARIFIER—Honan-Crane Corp, 500 Indianapolis Ave, Lebanon, Ind. 4-page folder presents a new high-flow-automatic oil clarifier for purifying honing and grinding oils or coolants used in large quantities in war production plants.

26 LUBRICATING SYSTEM — Trabon Engrg Corp, 1814 East 40th St, Cleveland, Ohio. 4-page folder describes the Trabon single-pipe centralized system that lubricates all connected bearings without employing any springs, diaphragms, packing or exposed moving parts.

27 CLARIFYING SYSTEM — Gale Oil Separator Co Inc, Chrysler Bldg, New York, N. Y. 4-page folder describes continuous circulating, intercepting and clarifying treatment system for cutting oils and coolants. Piping diagram shows how system works in clarification.

MATERIALS HANDLING

28 HOISTS—Coffing Hoist Co, Danville, Ill. 12-page catalog No. G-6 contains information, specifications and prices on company's complete line of hoists, trolleys, binders and utility maintenance tools.

29 TRAVELING CRANES — Reading Chain Block Corp, Reading, Pa. 16-page catalog A-42 discusses traveling

(Continued on page 172)

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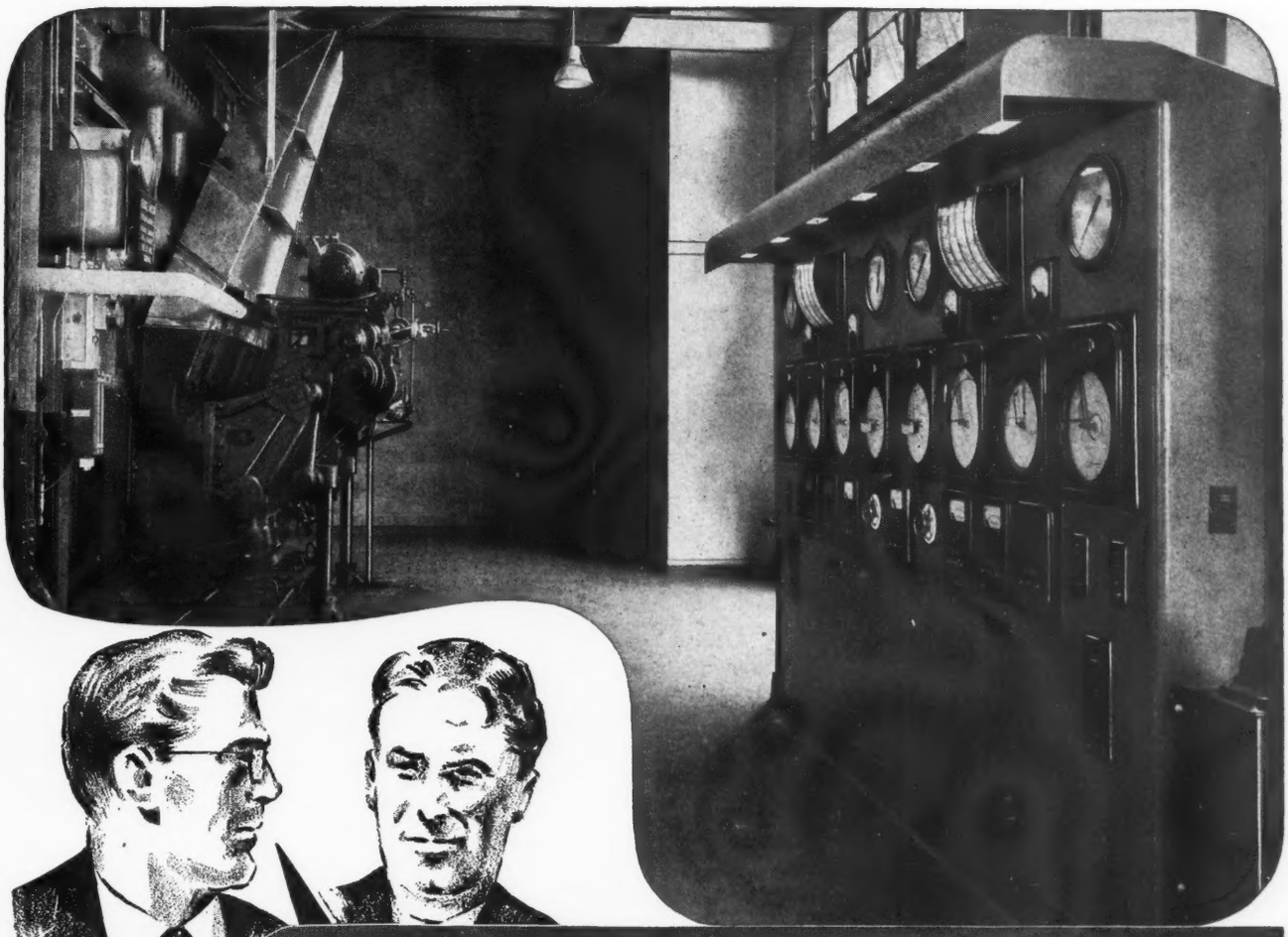


"WE SELECTED HAYS CONTROL BECAUSE IT IS EASIER FOR OUR OPERATORS TO UNDERSTAND"

...*So said* THE CHIEF ENGINEER of the above boiler room located in a mid-west municipal light plant. He went on to explain to two engineers* who were investigating several combustion control systems—

"Our men lived with Hays Automatic Combustion Control in our old plant for several years and they liked its simplicity, and its positive operation. Because it was easier to understand than the other systems on the market they took a keener interest in it and produced better results."

"Before selecting boiler control for our new high pressure plant I made trips to several near by cities inspecting the most recent installations of all types of control systems. These trips served to confirm my original opinion of Hays, so we selected Hays for our new plant also."

*The result of this interview was the sale of complete Hays Automatic Combustion Control for 7 boilers in a large automotive product plant.

HAYS *automatic* COMBUSTION CONTROL

is being preferred more and more over other control systems for very definite reasons. In the first place it is completely electric, which simplifies design, installation and operation.

It is the only system that has all instruments and controllers centralized on a single panel and not scattered all over the boiler room or hung on the side of the boiler. Adjustments are direct and not dependent on air pressures, oil pressures, and the complicated valve mechanisms made necessary by most other designs.

You will want to learn more about this thoroughly modern system that is maintaining boiler room efficiency and lowering operating costs in hundreds of plants. Send for 40-page catalog 41-304 today.

The HAYS CORPORATION
SINCE 1907 COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

3 BIG SAVINGS WITH ROPER Rotary PUMPS

SAVE 50% TIME

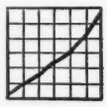
1 Saving of installation time is a most important need of plants producing for Victory — read what one customer writes "So far the new ROPER has proved the easiest of all to install. In fact the last 6 ROPERS we have installed, we saved 18 hours labor — about 3 hours on each."

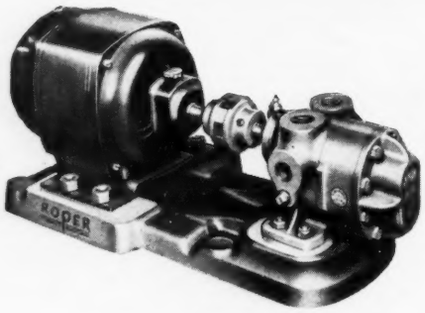
SAVE 52% SPACE

2 Today with increased production so vital plants welcome opportunities to get efficient equipment that gives them space savings. Roper "direct drive" pumps require only 48% as much floor space as other models.

SAVE 20% POWER

3 Here is another saving important to the Victory program — Roper "hydraulically balanced" Pumps reduce power consumption as much as 20%.





OTHER FEATURES

TIME, space and power savings are most important but remember other outstanding Roper features too! Ropers are "always primed" ready for action; are long on suction lift; quieter in operation; simplest in design — only two moving parts; automatically lubricated; leakproof; and absolutely dependable on long hard jobs.

THOUSANDS IN USE

Roper Rotaries are being used by the thousands in defense plants throughout the U. S. Their dependability and the savings they make possible are vital to all who must handle liquids. Manufacturing and processing industries must have trouble-free equipment — that's why "ROPER" is specified on so many purchase orders.

PUMPING ANY LIQUID

Whether for lubricating systems, general transfer work or for use on intricate hydraulic systems, there is a Roper to do the job. Roper Pumps can be standard fitted, bronze fitted or all bronze—capacities from 1 to 1000 gallons per minute—pressures up to 1000 lbs.—speeds to 1800 revolutions per minute—mountings and drives for every practical need.

HYDRAULICALLY BALANCED

THIS SEAL appears on every ROPER "hydraulically balanced" PUMP. It means higher efficiency, quieter operation, greater dependability and longer life.

Get this valuable Book of Pumping Information

Send for your free copy of catalog. Learn how you can save time, money and trouble.

ask for Catalog No. 944

GEO. D. ROPER CORP., ROCKFORD, ILL.

cranes and unit parts such as trolleys, end trucks, gears and cabs. On-the-job photographs show specific installations.

30 LIQUID HANDLING—S F Bowser, Fort Wayne, Ind. 40-page industrial equipment catalog covers the field of liquid handling and control by describing equipment for filtration and distillation, lubrication, metering, pumping, storage and dispensing of liquids.

31 CONVEYOR — Link-Belt Co, 307 North Michigan Ave, Chicago, Ill. 32-page catalog and data book No. 2075 announces two new sizes of Bulk-Flo elevator-conveyor. Book contains diagrams showing paths of operation, gives a list of materials that can be handled and includes illustrated case studies with tables of sizes, capacities, dimensions, etc.

32 CHAIN-TYPE CONVEYOR — Richards-Wilcox Mfg Co, Aurora, Ill. 36-page catalog A-78 illustrates typical installations of new chain-type conveyor system and gives brief data to show conditions under which application can be made, description of chain and drive and section drawing.

METERS, INSTRUMENTS & CONTROLS

33 INSTRUMENTS—Leeds & Northrup, 4934 Stenton Ave, Philadelphia, Pa. 16-page book entitled "Modern Precision" contains news of L&N instruments, controls and heat-treating methods and the job they are doing in industry, in research laboratories, in teaching and testing.

34 CONTROLS — C J Tagliabue Mfg Co, Park and Nostrand Aves, Brooklyn, N. Y. Catalog No. 900E describes TAG non-indicating temperature and pressure controllers with photographs, diagrams and tables of specifications.

35 INSTRUMENTS — Wheelco Instruments Co, 863 West Harrison St, Chicago, Ill. 16-page bulletin No. Z6000 describes and illustrates company's complete line of measuring and control instruments. Also lists prices and numbers of catalog sections for reference when full information is required on any item.

36 SPEED RECORDERS — Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia, Pa. Catalog N-27, 12 pages, describes Micromax speed recorders which measure and automatically record speed of rotating machinery. Also covers Micromax speed charts which help management study past performance and set up operating schedules.

37 INDICATOR — Trill Indicator Co, P O Box 5757, Pittsburgh, Pa. Leaflet No. T-421 gives complete descriptions of outside-spring indicator and auxiliary attachments which are used on Liberty ships and are applicable for stationary steam-engine service.

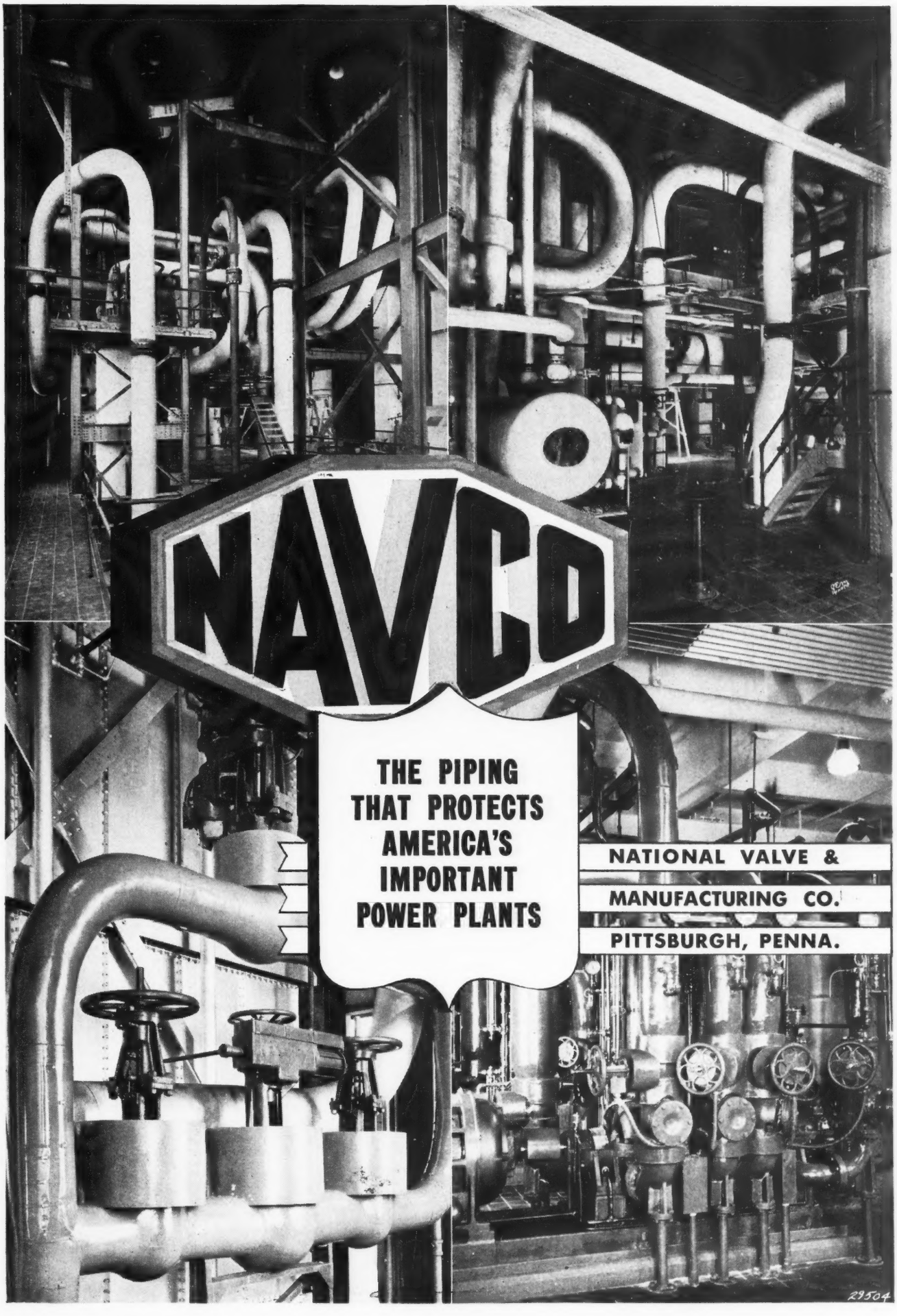
38 RECORDING THERMOMETERS—Bristol Co, Waterbury, Conn. 6-page folder, No. T302, discusses company's line of fully-compensated liquid-filled recording thermometers for temperatures between —125 F and 400 F. Also gives detailed information on construction and application of thermometers and various forms in which they are furnished.

39 INSTRUMENTS — Roller-Smith Co, Bethlehem, Pa. 12-page catalog, 4220, describes ac and dc indicating instruments for switchboard mounting. Dimensions, weights and list prices on all instruments are included.

40 CONTROLS—Foxboro Co. Foxboro, Mass. Bulletin No. A-330 explains theory of Hyper-Reset which is not an instrument or mechanism but a control function, available in the newly-designed model 30 Stabilog controller for applications where process-lag is considerable.

41 GAGE TESTER — Star Brass Mfg Co, 108-114 East Dedham St, Boston, Mass. Bulletin A-14-154, 4 pages, features the new Star Brass high-pressure dead-weight tester in four types—single range, high pressure, with and without reservoir, and double range with and without reservoir. Diagrams show principles of operation and design details.

42 PUMPING CONTROL—The Foxboro Co, Foxboro, Mass. 8-page bulletin, No. B-294, describes Rotax electric-operated control—in recording and indicating types, as employed in pumping appli-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THE PIPING
THAT PROTECTS
AMERICA'S
IMPORTANT
POWER PLANTS
NATIONAL VALVE &
MANUFACTURING CO.
PITTSBURGH, PENNA.
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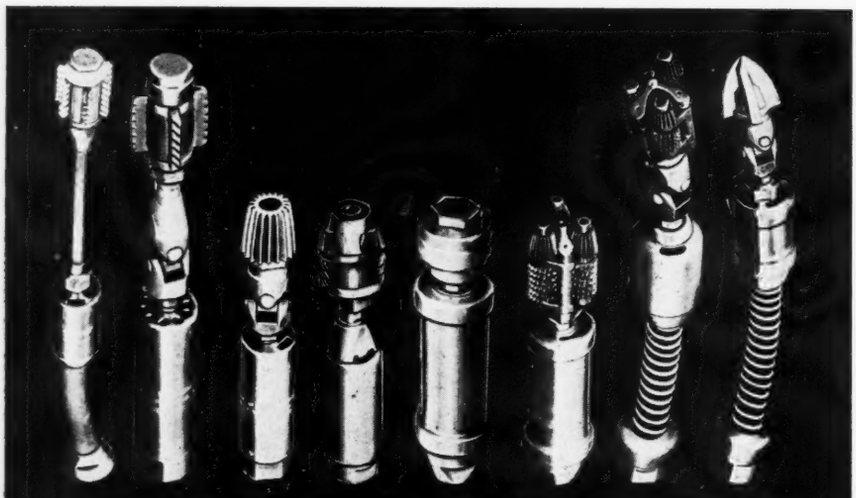


CLEAN BOILER TUBES
INCREASE PRODUCTION

The production of thousands of different materials essential to our war effort can be increased materially by keeping boilers at maximum efficiency. The surest and easiest way to do this is to keep tubes *clean*. *Clean* tubes *increase* steam output, *reduce* fuel costs and *increase* plant production. Don't let scale sabotage your boilers. Keep them working at maximum efficiency by cleaning them regularly with Wilson Tube Cleaners.

Wilson Tube Cleaners *reduce* tube cleaning time to a minimum and *increase* boiler efficiency to the maximum, and lengthen the time it can remain in use between cleanings. No matter what kind of tube must be cleaned, or what kind of deposit must be removed, there is a Wilson Tube Cleaner, cutter head, brush or other accessory which will do the work, *better, faster* and *more economically* and save time, labor and money and increase production.

Write for the name of our representative nearest to you or for a copy of our NEW forty-page catalog fully describing and illustrating the complete line of Wilson tube cleaning equipment.

THOMAS C. WILSON, Inc.
PIPE AND TUBE CLEANERS EXCLUSIVELY
47-28 37th Street Long Island City, N. Y.

"STANDCO" PILLOW BLOCKS

Built for trouble-free service; machined faces, broached babbitted bore, ample lubrication. Full range of sizes.

"HALLOWELL" STEEL SHAFT COLLARS

Fig. 1688

Precision machined, fitted with "Unbrako" Self-Locking Set Screw—and low-priced.
Write for Details

Fig. 1432 Patented

STANDARD PRESSED STEEL CO.
BOX 577 JENKINTOWN, PA.

cations. Schematic diagrams and photographs of typical installations are given together with specimen chart records.

43 PYROMETERS—Brown Instrument Co, Wayne & Roberts Aves, Philadelphia, Pa. 40-page bulletin, No. 1105, features design and operating features of Brown potentiometer pyrometer and accessory equipment. Also describes automatic control systems and explains their operation.

43A METERS—Republic Flow Meters Co, 2222 Diversey Parkway, Chicago, Ill. 16-page catalog describes and illustrates complete line of company's equipment, including meters for measuring flow, pressure, level and temperature of steam, water, gas, air and oil, CO_2 meters, pneumatic remote measurement and control systems; regulators, automatic combustion control; water level and pump controls.

MOTORS

44 MOTOR CARE—Allis-Chalmers Mfg Co, Milwaukee, Wis. New handbook entitled "A Guide to Wartime Care of Electric Motors" meets pressing problem of how to keep motors running under continuous service conditions. Taking a fresh slant on care of motors under war conditions, the book should prove of value to engineers and maintenance men and in training new operators. The handbook is an impartial study of all motor types.

PIPING, VALVES AND FITTINGS

45 IRON PIPE — Republic Steel Corp, Cleveland, Ohio. 48-page bulletin illustrates and outlines the history, properties and applications of Toncan iron pipe, including service records under severe conditions in several specific fields.

46 CONDUIT SYSTEM — Ric-wil Co, 1562 Union Commerce Bldg, Cleveland, Ohio. 12-page catalog "S" shows typical conduit fittings, pipe supports, glands, and pre-fabricated expansion loops complete with engineering details. Suggested specifications are included as well as tables of conduit capacities and required trench dimensions for each diameter unit.

47 PIPE FRICTION CHART — De Laval Steam Turbine Co, Trenton, N. J. Chart determines the pressure drop accompanying the flow of air or gas through pipes of known diameter and length. An auxiliary alignment chart simplifies the calculation for systems containing piping of various diameters.

48 VALVES—Everlasting Valve Co, 49 Fisk St, Jersey City, N. J. 32-page bulletin E-100 describes valves for boiler-room service with tables of specifications, dimensions and prices. Illustrations show design and construction of various Everlasting valve types.

49 PIPE BENDING — American Pipe Bending Machine Co, 37-39 Pearl St, Boston, Mass. Two single-sheet leaflets describe A-43 and V-42 types of pipe-bending machines. Type A-43 is a portable thin-wall-tubing bender and V-42 is designed for bending cold extra-heavy and standard-gage steel and wrought-iron pipe.

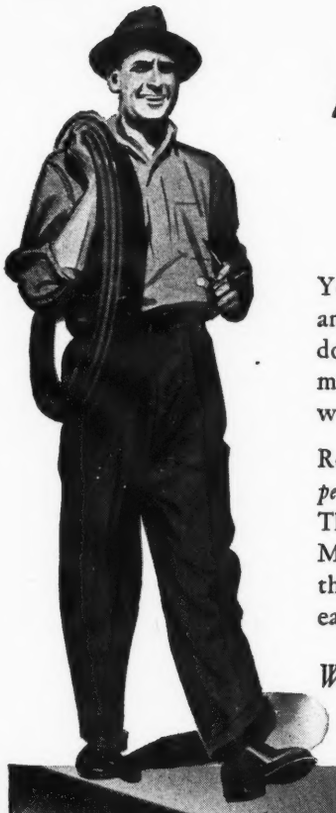
PRIME MOVERS

50 PISTON RINGS — Cooktite Ring Sales Co, 1737 Howard Ave, Chicago, Ill. 12-page bulletin, No. 5-342, entitled "Stop Compression Losses and Obtain 10 to 20% More Power" tells how Cook's graphite-iron piston rings prevent blowby completely, even in worn cylinders.

51 PISTON RINGS—Wilkening Mfg Co, Philadelphia, Pa. 60-page book discusses accepted practices in general motor reconditioning, with special emphasis on piston-ring installations. This discussion, illustrated by photographs, drawings and charts, is equally applicable to automotive engines, small power plants and stationary engines used in compression and refrigeration fields.

PUMPS

52 PUMPS — Quimby Pump Co, 340 Thomas St, Newark, N. J. 10-page stationary instruction manual contains information on installation, operation and maintenance of Quimby pumps under the



A Little Rockbestos A.V.C.

GOES A LONG, LONG WAY

You can get MORE out of LESS if you use Rockbestos A.V.C. in places where heat and moisture, corrosive fumes, grease or oil are causing wire failures too often. It does away with shut-downs, production losses and repeated rewiring around boilers, motors, soaking pits, steam lines, furnaces, hot tunnels, kilns, and lehrs because it won't bake out, crack, bloom, flow or rot.

Rockbestos A.V.C. Power Cable, Motor Lead Cable and Boiler Room Wire have *permanent insulation* that stands up in the hot spots under the most severe conditions. They protect your power, control and lighting circuits with *built-in* failure prevention. Make your plans now to crack down on shut-downs by using Rockbestos A.V.C. in the hot spots in your plant. Anticipate your requirements and order now to get the earliest possible delivery.

Write to Rockbestos Products Corporation, 859 Nicoll St., New Haven, Conn.

Built for Steady Service Under Severe Conditions

Rockbestos A.V.C. Power Cable (Underwriters' and National Electrical Code Type AVA) for locations where heat and moisture, oil, grease and corrosive fumes make trouble, has a maximum operating temperature of 110°C. (230°F.) because of these insulation features.*

1. Tough, rugged, impregnated asbestos braid that insures positive protection against heat, flame, moisture, oil, grease and corrosive fumes.

2. Felted asbestos insulation which serves as a heat-seal against high ambient temperatures.

3. High-dielectric, moisture resistant varnished cambric, sealed away from heat, flame and oxidation between two felted asbestos walls.

4. Inner felted asbestos wall which is unaffected by conductor-heating overloads and doesn't burn even when exposed to copper-melting arcs.

*This type of construction also used in Boiler Room or Lighting Wire, Motor Lead Cable, Control Cable and other Rockbestos A.V.C. constructions.

When ordering Rockbestos A.V.C. for hot-spot wiring, don't forget to furnish preference rating papers and give your end-use classification — saves correspondence and gets the wire to you faster.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK BUFFALO CLEVELAND CHICAGO PITTSBURGH ST. LOUIS SAN FRANCISCO PORTLAND, ORE. SEATTLE

LONG SERVICE-LOW MAINTENANCE
MORE PRODUCTION
with
TANNATE LEATHER BELTING

Tannate has high overload capacity. It is stronger than most first-quality oak belting. It resists high temperatures, water, machine oil and many chemicals. And, Tannate is pre-stretched; needs far fewer shutdowns for take-up.

With little care other than an occasional application of Rhoads belt dressing, Tannate leather belts outpull and outlast ordinary belts . . . run smoothly . . . keep machines at maximum speed with fewer stops for maintenance.

GET THE MOST FROM PRESENT EQUIPMENT

You'll get top machine speeds even at peak loads. You'll see production schedules take a turn upward. You'll get more uniform work, less spoilage, fewer shutdowns, reduced unit cost with Tannate. Why not give Tannate leather belting a trial in your plant?

Shown here is a Rhoads leather belt, 4 feet wide by 110 feet 9 inches long installed on a Corliss engine in July, 1941. It replaced another Rhoads belt that had run since 1897!

STEP UP PRODUCTION with
RHOADS *Tannate*
WATERSHED LEATHER BELTING

Established 1702

J.E. RHOADS & SONS · 35 N. SIXTH ST., PHILA., PA. · NEW YORK · CHICAGO · ATLANTA · CLEVELAND

heading "Cues to Better Pumping Practice". This information is applicable to other types of pumps as well.

53 PUMPS—Goulds Pumps, Inc, Dept 57, Seneca Falls, N. Y. 18-page booklet "Pump Fundamentals" with pump application data sheets containing both elementary and advanced technical data on selection, installation, operation and maintenance of all industrial pump types for general and specialized services.

54 PUMPS—U S Stoneware Co, Akron, Ohio. 4-page bulletin features centrifugal acid pumps for all hot or cold corrosive solutions. Booklet contains characteristic performance curves as well as photographs and diagrams which give complete specifications.

55 CENTRIFUGAL PUMPS — Worthington Pump & Machinery Co, Harrison, N. J. 4-page bulletin, W-312-B2C, features single-stage volute, type L, in capacities to 2000 gpm, heads to 300 feet. Photographs, tables, and diagrams show standard features, specifications, dimensions, capacities, heads and speeds.

WATER TREATMENT

56 CHEMICAL FEEDERS — Wilson Chemical Feeders, Inc., Buffalo, N. Y. Well-illustrated bulletin covers "Pulsafeeder" unit for injecting water-treating chemicals. Includes data on construction, uses, controls and application for wide range of jobs and chemicals.

57 WATER TREATMENT — Water Treatment Co of America, 1159 Hodgkiss St, Pittsburgh, Pa. 10-page booklet discusses the "Technical" water-conditioning system which provides power-plant and condenser-system operators with a closely supervised system for controlling water condition to prevent all forms of water damage and difficulty in operation. Includes diagrams and data on causes of boiler scale.

58 WATER TREATMENT — Graver Tank & Mfg Co, Inc, East Chicago, Ind. Bulletin No. 310 describes Graver chemical proportioneer, a new device providing accurate control of chemicals fed into the water-treating plant in proportion to the volume of water. Permits instant increase or reduction of chemical charge over wide range.

OTHER EQUIPMENT

59 RESURFACER—Flexrock Co, 23rd & Manning St, Philadelphia, Pa. 4-page folder introduces Floor Patch, an instant-use resurfacer, for patching ruts and holes without mixing, waiting or tying up traffic.

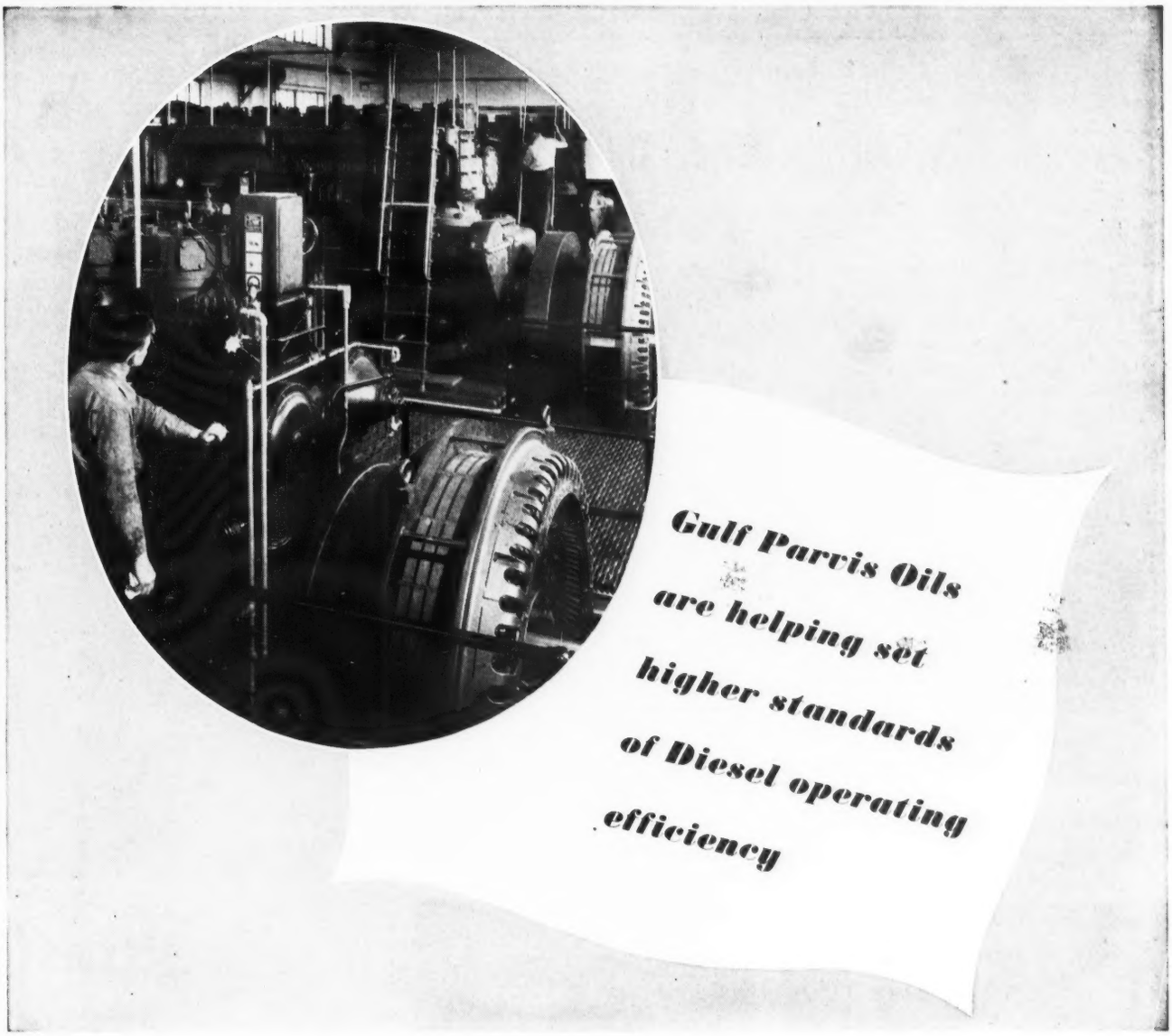
All literature designated with a star (★) may be obtained only by writing directly to the manufacturer on company letterhead, giving writer's name and title.

★ SPRAY PAINTING—Binks Mfg Co, 3114-40 Carroll Ave, Chicago, Ill. Catalog No. 80 emphasizes part of spray painting and finishing in war production with special reference to spray-painting installations, paint circulating systems, spray booths of both dry and water-wash types, exhaust systems, and automatic spray finishing equipment for the coating of bombs and shells.

61 SIRENS—Star Brass Mfg Co, 108-114 East Dedham St, Boston, Mass. 4-page folder outlines steam and air sirens, suitable for air-raid warning service, with photographs of each type. Also contains discussion of design and materials, which is resume of specifications.

62 RUBBER CONSERVATION—U. S. Rubber Co, 1230 Sixth Ave, New York, N. Y. 48-page rubber-conservation manual discusses ways and means of making the present supply of rubber goods for civilian use last longer. Among the rubber products discussed are: hose, transmission, conveyor and elevator belts, mechanical packings, electrical tapes, wires and cables.

63 LOCK NUTS—An-cor-lox Division, Laminated Shim Co Inc, 86 Union St, Glenbrook, Conn. 6-page folder is



Many Diesel Operators report large savings in maintenance costs and other important benefits with these quality lubricating oils in service

"GULF Parvis Oils are the most satisfactory Diesel lubricants we've ever used," says the Chief Engineer of a large municipal power plant. "With these quality oils in service, our over-all efficiency is greater and maintenance costs are lower."

The *higher protection value* of Gulf Parvis Oils shows up today—when power demands can be met only by peak-load operation of Diesel units. For severe service proves the endurance and stability of these oils. They stand up and provide full protection under conditions which often cause excessive wear to moving parts, high maintenance expense, and below standard Diesel performance.

For higher operating economy in *your* plant, take this step today: Call in a Gulf engineer and ask him to recommend the proper grade of Gulf Parvis Oil to fit your particular requirements. His thorough training and broad experience with all types of Diesel engines is your assurance of sound recommendations.

5 reasons why

Gulf Parvis Oils Improve Diesel Performance and Reduce Operating Costs

1. GULF PARVIS OILS are especially manufactured for lubrication of Diesel engines. High temperatures, contamination with fuel and moisture and constant churning in the presence of air—all encountered in Diesel engine operation—necessitate the use of an oil especially prepared to withstand these conditions.

2. GULF PARVIS OILS insure minimum wear of cylinders, pistons and bearings. The tough film provided by GULF PARVIS OILS is not readily removed from the cylinder walls and pistons, insuring proper lubrication of these parts at all times.

3. GULF PARVIS OILS insure minimum consumption. Because they are made from specially selected crudes and manufactured by the most modern refining methods GULF PARVIS OILS withstand the high temperatures encountered in Diesel engine operation. A minimum of make-up oil is required.

4. GULF PARVIS OILS reduce operating costs. Because of the stability and high lubricating quality of these oils, wear and repair expense are minimized. Lower oil consumption and lower maintenance costs reflect substantial savings in over-all operating costs.

5. GULF PARVIS OILS are low in carbon content —a safeguard against carbon deposits resulting from the lubricating oil. With good atomization of fuel and complete combustion, rings retain their freedom. Thus the oil contributes to full power and operating efficiency.

Oil Is Ammunition — — Use It Wisely!

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GULF BUILDING · PITTSBURGH, PA.

GULF INDUSTRIAL LUBRICATION

NEW DEVELOPMENTS BY FREDERICK ADD NEW THRIFT AND CONVENIENCE TO INDUSTRIAL STOKERS

From careful analysis of common stoker faults . . . the re-designed line of Frederick Stokers . . . engineered to correct them.

FULLY ACTIVE GRATE SURFACE. More grate area with low combustion rate per square foot! . . . Frederick Stokers has specially designed tuyeres with air ports arranged and proportioned to improve air distribution and insure maximum efficiency in combustion.

TUYERES ARE LOCKED IN PLACE—can't be removed without removing the locking rod—can't be raked up inadvertently.

WIND BOX IS COMPLETELY ENCLOSED. Simplifies and makes a neater installation; eliminates danger of efficiency loss through leaking brickwork.

DOUBLE CLEAN-OUT—gives easy access to *both* sides of the undergrate area. Permits thorough cleaning, faster.

Illustration shows bin feed model stoker

50% OVERSIZE MOTORS—PROPORTIONED AIR SYSTEM—IMPROVED HEAVY DUTY TRANSMISSION—*Ask about all these; just write*—

The Frederick Iron & Steel Company • Frederick, Md.

COMPLETE LINE OF CENTRIFUGAL PUMPS FOR ALL PURPOSES

STEAM OPERATED ASH CONVEYING SYSTEMS - ASH STORAGE BINS

XZIT

frees scale and soot from your boilers

FIRE SCALE AND SOOT ERADICATOR

Step up efficiency without shutting down

Now is the time to clean your boilers with XZIT and save time, labor, money and fuel—now when every extra pound of steam capacity is necessary to meet the "all out" demand for power.

Xzit FIRE SCALE and SOOT ERADICATOR provides a simple way to keep boiler heating surfaces clean even though you may be forced to use lower grade fuels. This scientific combination of chemicals, spread over a hot coal bed or through peep hole of an oil-fired furnace loosens or dries the binder out of soot and scale making it easily removed. Continued use of Xzit prevents further formation of scale.

Xzit also cleans uptakes breechings and stacks. It is harmless to metal or brickwork. Its efficiency depends on use while boiler is hot and is applied while boilers are in regular operation. Xzit has been tried and proved in all types of boilers.

INVESTIGATE TODAY

Write for full information. Let us answer your questions about XZIT and show you how easy it is to use.

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Openings are available for sales representatives in a few desirable territories.

XZIT SALES COMPANY

1031 CLINTON STREET HOBOKEN, NEW JERSEY

replete with diagrammatic, photographic and factual matter on An-cor-lox styles, materials, designs and finishes; application constructions; and suggestion for parts conversion to the An-cor-lox function.

64 SAFETY—A Schrader's Son, 470 Vanderbilt Ave, Brooklyn, N. Y. 4-page pamphlet gives information on equipment which will reduce accidents through use of compressed air. The safety installations described are said to be easy to install and operate and to increase production.

65 WATERPROOFING—Medusa Portland Cement Co, 1000 Midland Bldg, Cleveland, Ohio. Booklet entitled "How to Waterproof Concrete, Stucco and Masonry" explains how lack of waterproofing causes damage in buildings. Covers various waterproofing methods and advantages of integral waterproofing and gives specification for waterproofing concrete and stucco.

66 RUBBER CONSERVATION—Manhattan Rubber Mfg Div, Passaic, N. J. Two 8¾ x 11 in. wall charts give information on proper care of rubber hose; the first covers fire hose and the second lists rules for proper care of air, water, steam, and other types of rubber hose and for attaching couplings properly.

67 FORGED SPECIALTIES — Lenape Hydraulic Pressing & Forging Co, P O Box 536, West Chester, Pa. 32-page catalog, 8-42, introduces and gives details of standard line of accessories in pressure-vessel construction. Photographs, diagrams and specification tables cover welding necks, nozzles, elliptical handholes and manholes etc. Also contains general reference data.

68 WELDING — The Lincoln Electric Co, Cleveland, Ohio. 18-page bulletin, 432, compares the new "Fleet-Fillet" technique of arc welding with conventional methods as regards angle of electrode, weld penetration, weld strength, deposited metal and speed of welding, for both single and multiple-pass welds.

69 MAINTENANCE — Johns-Manville, 22 East 40th St., New York, N. Y. 8-page book, Form PP-9A, outlines in tabular form many hints on lengthening life of packings, insulations, roofings, friction materials, and refractory products. The manual also contains a summary of good installation and maintenance practices, providing a handy guide for maintenance engineers.

New Power Construction

Construction to Come

California—Yards & Docks, Navy Dept, 18 St and Constitution Ave N W, Wash., D. C., will not construct station, utilities. $30,000,000. Project abandoned.

Calif., Burbank—City plans constructing 10,000-kw steam-electric generating plant, Docket, Calif. 4-258. $900,000. FWA. H I Stites, city mgr.

Calif., Lake Merced—City and County of San Francisco, City Hall, San Francisco, voted bonds constructing auxiliary pump plant. $1,250,000.

Idaho—Bids July 6, by U S Engrs, Pittock Bldg, Portland, Ore., constructing water-supply lines, distr system, storage tank and tower, pumphouses, deep-well pumps, sewers, etc.

Indiana—Yards & Docks, Navy Dept, 18 St and Constitution Ave N W, Wash., D. C., plans constructing bldgs, brick, steel, concrete. Shreve, Anderson and Walker, 914 Marquette Bldg, Detroit, Mich., archts.

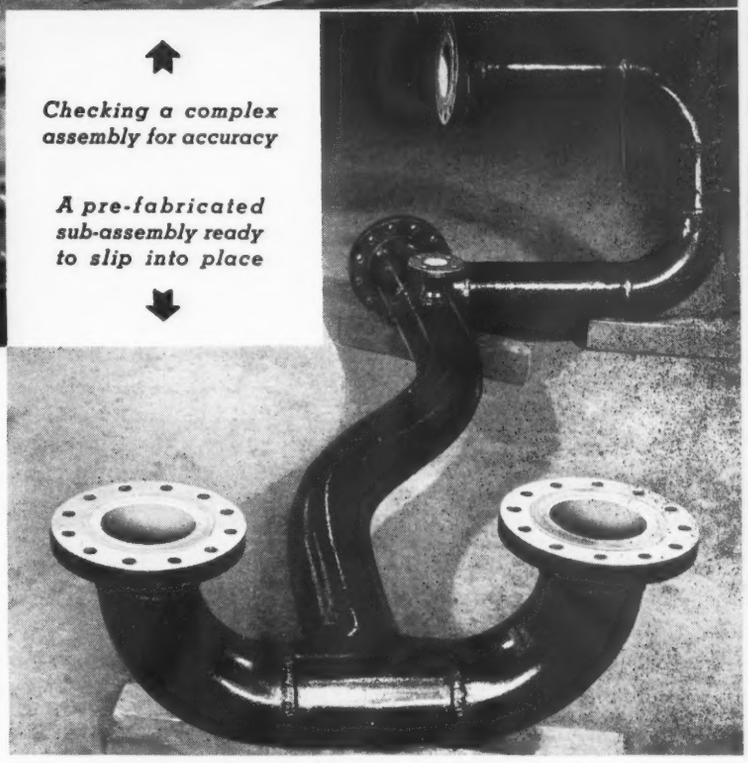
Iowa—Dept Agriculture, The Mall, between 12 and 14 Sts N W, Wash., D. C., plans constructing egg-drying plant. Less than $1,000,000. Swift & Co will operate.

Iowa, Oelwein—Bids July 24, by H J Finders, city clerk, constructing waterworks impvrs, pump-house bldg, reservoir. $60,000.

Kansas—War Dept, 20 St and Constitution Ave N W, Wash., D. C., plans constructing buildings. Over $3,000,000.

Checking a complex assembly for accuracy

A pre-fabricated sub-assembly ready to slip into place



Complex PIPING PROBLEMS made *Simple*

AT Pittsburgh Piping, complex piping assemblies are fabricated by proven techniques that insure compliance with specifications and accurate workmanship. Pre-fabricated assemblies, which are shipped ready to slip-into-place, simplify field installation. These units are thoroughly inspected and tested for accuracy of dimensions, and quality of welding to assure safety of operation.

Pittsburgh Piping is equipped to fabricate and erect all types of piping for central stations, industrial and process plants. Where time and space are factors, our trained men and modern specialized facilities enable us to meet your piping requirements and help you to "Beat the Schedule."

Pittsburgh Piping

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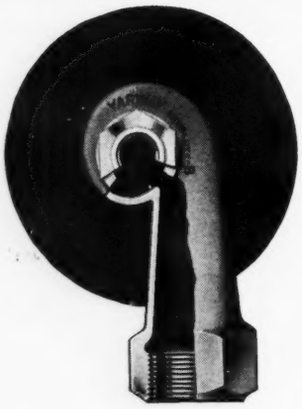
YARWAY INVOLUTE SPRAY NOZZLES



Unique Yarway Involute design.

No internal parts or vanes to clog or erode.

Unobstructed flow gives minimum loss of head.

Finely divided spray cone provides rapid cooling.

Renewable orifices adapt nozzles for any service.

Installations total more than 5 million gallons per minute in water cooling and air conditioning service.

Made in both cast and bar-stock types. All sizes from 1/4 in. to 2 1/2 in. Write for Catalog N-615.

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100 Mermaid Ave. Philadelphia

Howard-Needles, Tammen & Bergendorff, 1012 Baltimore St, Kansas City, Mo., engrs.

Kentucky—U S Engrs, 612 Federal Bldg, P O Box 59, Louisville, plans constructing mfg plant. Over $3,000,000.

Massachusetts—Bids July 6, by General Electric Co, 920 Western Ave, Lynn, constructing plant, No. 64-7. $40,000.

Missouri—U S Engrs, Courthouse & Customhouse, St. Louis, plans constructing plant. Over $3,000,000. Mauran, Russell, Crowell & Mullgardt, 721 Olive St, St. Louis, and Giffels & Vallet, Inc, 1000 Marquette Bldg, Detroit, archts and engrs.

Missouri—U S Engrs, 601 Davidson Bldg, Kansas City, plans constructing plant. $8,000,000. Total cost $85,000,000, incl equip, materials, etc. Industrial Co will operate. A Kahn, Inc, 345 New Center Bldg, Detroit, Mich., engr. Defense Plant Corp will finance.

Nebraska— U S Engrs, 1709 Jackson St, Omaha, negotiations letter of intent with E I Du Pont de Nemous & Co, Wilmington, Del., for design and operation mfg plant. Over $3,000,000.

Nebraska—U S Engrs, 1709 Jackson St, Omaha, plans constructing mfg plant. Over $3,000,000.

Nebraska—U S Engrs, 1709 Jackson St, Omaha, plans constructing school. Over $5,000,000.

Nebraska—U S Engrs, 1709 Jackson St, Omaha, Neb., plans constructing impvrs bldg. Over $5,000,000. G M Musick, 1000 Patterson Bldg, Denver, Colo., archt.

N. Carolina—U S Engrs, 33 Customhouse, Charleston, S. C., plans constructing improvements. Over $3,000,000. Houston-Johnston, Atlanta, Ga., and Metcalf & Eddy, 1300 Statler Bldg, Boston, Mass., archts and engrs.

Ohio—Electro Metallurgical Co, 30 E 42 St, New York, N. Y., plans constructing plant. Over $2,500,000.

Ohio—Industrial Co soon lets contract constructing factory and storage bldg. $3,000,000. Albert Kahn, Inc, New Center Bldg, Detroit, Mich., engrs and archts.

Ohio—Industrial Co plans constructing plant, $2,500,000. E R McGeorge & W R Hargett, Quincy Ave, Cleveland, engrs.

Ohio, Cleveland—City Bond election in August, constructing new out-patient bldg, heating plant, repairing bldgs. $1,000,000. H Krehelius, 517 City Hall, archt.

Oklahoma—Associated Refineries, Inc, c/o M L Freese, vice-pres Bell Oil & Gas Co, Natl Bank of Tulsa Bldg., Tulsa, Okla., plans constructing refinery. $10,500,000. Federally financed.

Pennsylvania—Industrial Co plans constructing administration bldgs, Janssen & Cocken, Century Bldg, Pittsburgh, archts; industrial bldgs, incl processing plant, offices, manufacturing areas, etc, Prack & Prack, Martin Bldg, Pittsburgh, archts. Norris Knowles Co, 1312 Park Bldg, Pittsburgh, engr for waterlines, sewers, pump sta, reservoir. Over $5,000,000. Federally financed.

Pa., Williamsport—Pennsylvania Power & Light Co, Williamsport, plans constructing addnl boiler unit, steam-generating plant, foot of Hepburn St, $40,000.

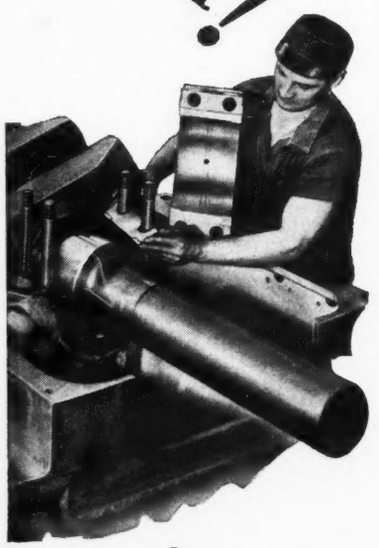
Tennessee—U S Engrs, 306 U S Courthouse, Nashville, plans constructing mfg plant. Industrial Company will operate.

Tennessee—U S Engrs, 1420 Enquirer Bldg, Cincinnati, O., plans constructing mfg plant. Over $3,000,000.

Texas and Illinois—Cities Service Oil Co, 70 Pine St, New York, N. Y., Atlantic Refinery, Sun Oil Co, Standard Oil Companies of New York and New Jersey, The Texas Co, Tide Water Co, et al, receiving bids laying 24-in. main pipeline carrier between Longview, Tex., and Salem, Ill., or Mt. Vernon, Ind. $28,000,000. RFC will finance.

Texas—Goodrich Tire & Rubber Co, 500 S Main St, Akron, O., plans constructing plant. $22,000,000. Defense Plant

pressure-proof!



CONSERVE machine efficiency! *Babbitt-tipped* Laminum shims, for pressure-lubricated systems, prevent oil and pressure losses. Body of shim retains all Laminum features of quick precision adjustment by *peeling* . . . in factory assembly or field service.

The .003 or .002 in. laminations are bonded into a solid unit . . . easy to peel.

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THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

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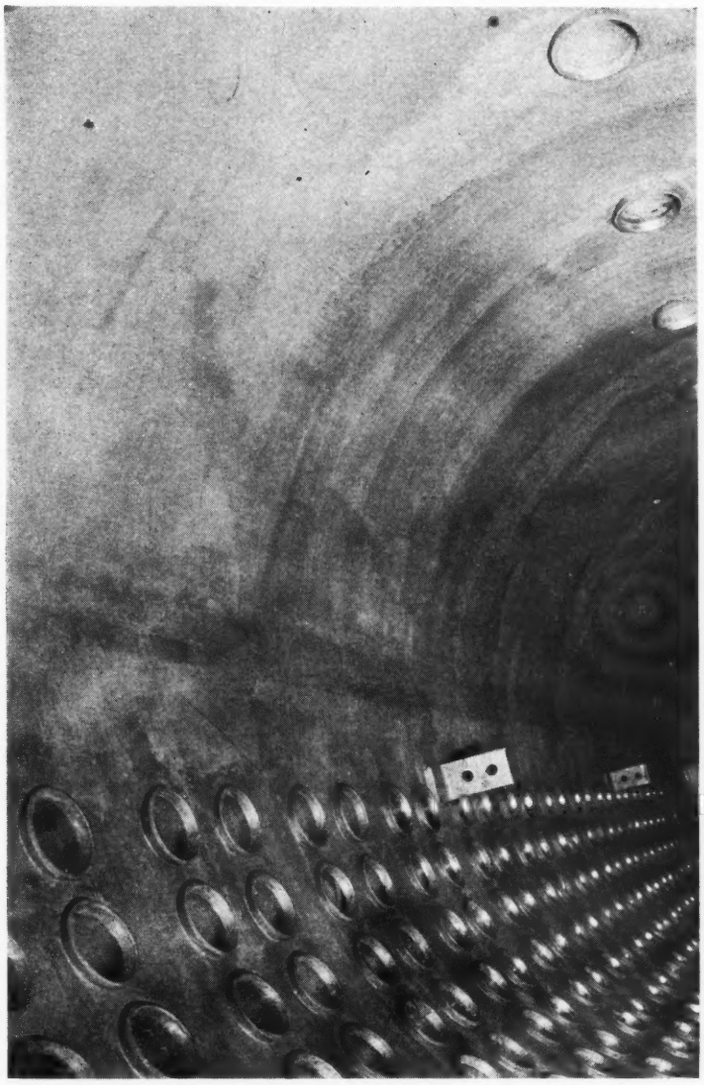

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You'd scarcely throw a house away because the roof was worn. Boilers, too, can be kept in service by resurfacing irreplaceable boiler metal with a protective APEXIOR coating.

On boiler metal, even so old and worn that it is ready to be junked, APEXIOR has repeatedly kept equipment in service indefinitely. Just clean down to bare metal. Then if the required hydrostatic test can be passed, simply "painting" it with APEXIOR NUMBER 1 will keep that equipment on the line.

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Easily applied with a hand-brush or power-coater, APEXIOR NUMBER 1 adds an impenetrable, durable barrier on boiler tubes and drums, stopping corrosion and resisting wear. It is a chemically inert, mechanical coating which seals up the pores and joints, prevents corrosion from penetrating, taking the wear instead of the metal.

Any scale that may form is loosely adherent, unable to bond chemically with tube and drum walls, and can be removed by wire brushing.

And it *lasts* — two, three years, or more. Then, one-coat resurfacing is all that is needed.

APEXIOR Guarantees Good Metal Condition— No Other Protection Offers the Same Assurance and Security

APEXIOR NUMBER 1 supplements feedwater treatment, giving *extra* protection and that peace of mind that comes from knowing that *everything* has been done to insure maximum life and good housekeeping to steam boiler equipment.

For years, power engineers with a desire for peak efficiency have found it valuable. Now, *every* plant must have this assurance in coaxing top production, long life and availability from irreplaceable equipment.

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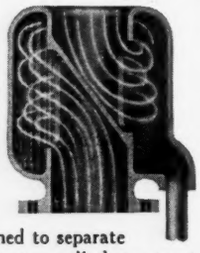
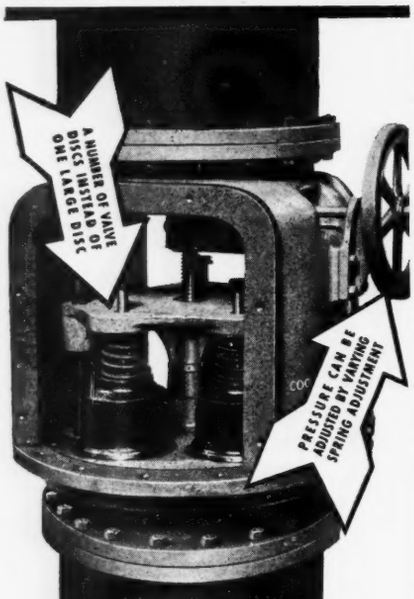
COCHRANE
Exhaust Head



Incorporates a highly efficient free-flowing baffle type construction and large port area to minimize back pressure. The Cochrane Exhaust Head is designed to separate condensate and oil from steam discharge to atmosphere and prevent raining of water and oily condensate on the roof. Ask for Publication 2960.



The Multiport principle of using a number of small discs instead of one large one eliminates sticking, freezing and jamming common in single disc valves used to control atmospheric relief, back pressure, etc.

Cochrane Multiport Valves have been giving successful service for many years in more than 12,000 plants. Ask for Publication 2870.

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Cochrane

MULTIPORT RELIEF VALVE

518,750. Defense Plant Corp will finance.

Tex., Edinburg—Central Power & Light Co, 215 E Harriman St, plans constructing 1-story, brick, rein-concrete-mfg unit. About $40,000.

Wisconsin—U S Eng, 408 Federal Bldg, Milwaukee, plans by Smith-Hinchman & Grylls, archts and engrs, 800 Marquette Bldg, Detroit, Mich., constructing plant. Over $3,000,000.

Contracts Let

Alabama—U S Engrs, Bynum, awarded contract constructing central heating plant, to Perusini Constr Co, Martin Bldg, Birmingham.

Ala., Gorgas—Albama Power Co, 600 N 18 St, Birmingham, awarded contract constructing superstructure for steam-generator plant (60,000-kw unit) to Wilborn Constr Co, 830 2 Ave N, Birmingham; plumbing, to G A Crook Plumbing & Heating Co, 517 55 Pl, S, Birmingham. Est. $6,000,000.

Arizona and Nevada—Bureau Reclamation, Customhouse, Denver, Colo., awarded contract for generators for Davis Power Plant, Spec 1034, to General Electric Co, 650 17 St, Denver, Colo., $2,487,000. Bids 6/9. Awarded 6/12. S O Harper, Customhouse, Denver, Colo., engr.

California—Industrial Co awarded contract for design and construction refinery unit, to Lummus Co (engrs), 420 Lexington Ave, New York, N. Y.; 116x430 ft, concrete pumphouse, to C C Moore, Richfield Bldg, Los Angeles. Total est $4,000,000. Federally financed.

California—Industrial Co awarded contract constructing plant, to Swinnerton & Walberg, 225 Bush St, San Francisco. Est over $6,000,000. Defense Plant Corp will finance. Giffels & Vallett, 1000 Marquette Bldg, Detroit, Mich., archts.

Colorado—U S Eng, c/o Postmaster, Denver, awarded contract constructing steam-distr system, power plant, to Woehler & Force, Greeley, Colo. Davis & Wilson, Lowry Field. Denver, archts and engrs.

Conn., Hartford—Hartford Electric Light Co, 266 Pearl St, awarded contract constructing 1-story, brick, steel concrete power-plant addn, to Stone & Webster Engrg Corp, 49 Federal St, Boston, Mass., $100,000.

Florida—U S Engrs, Courthouse & Portoffice, Jacksonville, awarded contract constructing boiler house, steam-distr system to Moody Bros Plumbing & Heating Co, Ft. Myers, under $1,000,000.

Florida—U S Engrs, 240 U S Courthouse & Post Office, Jacksonville, awarded contract constructing cold-storage system, Inv 436-42, to Falkner, Inc, Orland, less than $1,000,000.

Illinois—Industrial Co awarded contract for design and construction, plant, etc, to Austin Co, 510 N Dearborn St, Chicago. Est $20,000,000. Federally financed.

Illinois—Industrial Co awarded contract constructing plant addn, etc, to Fruin-Colnon Contg Co, 408 Olive St, St. Louis, Mo. Est less than $5,000,000. Defense Plant will finance. J G Turnbull & Sverdrup & Parcel, 1781 Railway Exch Bldg, St. Louis, Mo., engrs.

Indiana—Industrial Co awarded contract constructing plant, to Stone & Webster Engrg Co, 38 Dearborn St, Chicago, Ill. Est over $100,000,000. Defense Plant Corp will finance.

Indiana—Industrial Co awarded contract constructing plant, to W E Mohler Co, Archts & Bldrs Bldg, L Colvin, 507 Bd Trade Bldg, Indianapolis. Est over $5,000,000. Defense Plant Corp will finance.

Kentucky—Industrial Co awarded contract constructing plant, to Struck Constr Co, 147 N Clay St, Louisville. Est $12,000,000.

Maryland—Industrial Co awarded contract constructing power house, sub-station, to Consolidated Eng Co, 20 E Franklin St, Baltimore. $75,000; electric substation, to Cummins Const Co, 803 Cathedral St, Baltimore, $100,000.

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For valve stems; each strand a perfect piece of lubricated packing.

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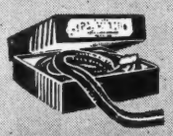
For rods and shafts; layer over layer construction insures uniformly even bearing surfaces.



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for steam, hot water, air. PALCO *for water.* PELRO *for oils.* CUTNO *for alkalis.* SUPERCUTNO *(blue asbestos) for acids.* KLERO *for foods.*

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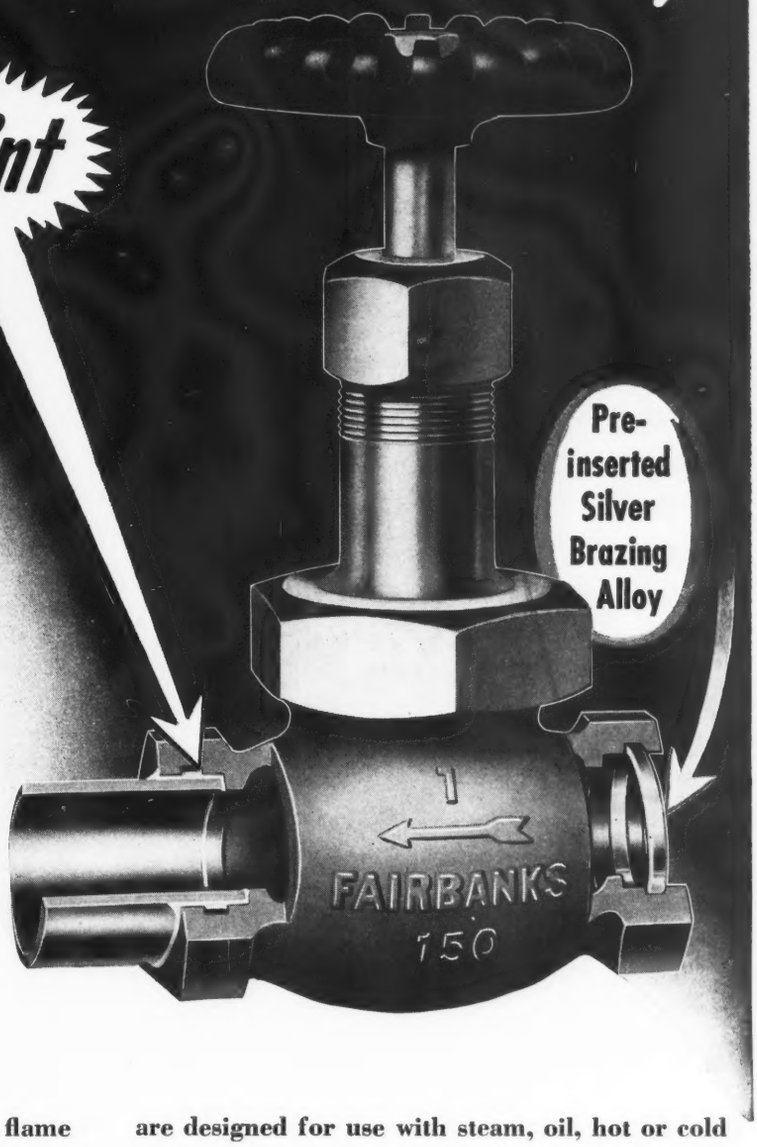
Braze Valve and Pipe Together!

Silbraz Joint



Faircoseal Valves are designed to make a Silbraz joint with Brass or Copper Pipe and Tubing. A Silbraz joint is a silver brazed joint—not threaded—not soldered.

The portway ends of the valve are plain-bored, with a recess in each end. Into each recess there is inserted, at our factory, a ring of Sil-Fos silver brazing alloy. This Sil-Fos ring has exactly the right kind and right quantity of brazing alloy to make a perfect joint without guesswork or waste of material.

After inserting the pipe into the valve port openings, the application of heat from an oxy-acetylene flame causes the brazing alloy to flow evenly between valve and pipe, thus forming a joint that is stronger than the parts joined. In resistance to heat, vibration and torsional strains, Silbraz joints are fully equal to the strength of the pipe or valve.

Faircoseal Valves, for making Silbraz joints, are designed for use with steam, oil, hot or cold water, compressed air, acid, Freon, sulphur dioxide, etc.

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Scale, corrosion, pitting may be building up for trouble in YOUR system. There is NO "patent-medicine cure-all" for such a problem. It requires a thoroughly scientific DIAGNOSIS—and a SUHM INDIVIDUALIZED BOILER WATER TREATMENT. For no two plants have the same water analysis, or the same operating conditions.

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Please send me a jug and shipping container in which to return a sample of our Raw Water for Analysis and recommendations without obligation.

Name.....

Address.....

Michigan—Industrial Co awarded contract constructing plant, to J A Utley Co, 723 E 10 Mile Rd, Royal Oak. $1,197,000. Defense Plant Corp will finance.

Michigan—U S Engrs, 700 Union Guardian Bldg, Detroit, awarded contract constructing diesel-electric power plant, to Worthington Pump & Mchy Co, Harrison, N. J., less than $1,000,000.

Michigan—U S Engrs, 700 Union Guardian Bldg, Detroit, awarded contract constructing cold-storage bldgs, to Strom Constr Co, 452 Houseman Bldg, Grand Rapids, less than $1,000,000.

Missouri—Industrial Co awarded contract constructing plant, to George A Fuller Co, 597 Madison Ave, New York, N. Y. Est. $1,100,000. Defense Plant Corp will finance.

N. J., Jersey City—Pub Serv Electric & Gas Co, 80 Park Pl, Newark, awarded contract altering 50x63x60 ft brick, steel-generator station, boiler and blower-room addn, Duffield Ave, to Becker Constr Co, 361 Grove St, Newark, $90,000.

North Carolina—Federal Works Agency, 18 and F Sts N W, Wash., D. C., will construct dam and hydroelectric plant. Yadkin River Project, own forces. Est $8,000,000. W R Holway & Associates, 302 E 18 St, Tulsa, Okla., engrs. K Markwell, proj engr.

Ohio—Industrial Co awarded contract constructing plant, to Hunkin-Conkey Constr Co, 1740 E 12 St, Cleveland. Est $5,000,000. Defense Plant Corp will finance.

Ohio—Industrial Co awarded contract constructing bldgs, to H L Vokes Co, 5300 Chester Ave, Cleveland. Est $3,000,000. Defense Plant Corp will finance. T W Lamb Associates, Inc, 36 W 40 St, New York, N Y. archts.

Ohio—Industrial Co awarded contract constructing factory, boiler house and transformer bldg, to Sam W Emerson Co, 1836 Euclid Ave, Cleveland. Est $4,000,000, complete. Wilbur Watson & Associates, 4614 Prospect Ave, Cleveland, engrs.

Pennsylvania — Industrial Co awarded contract constructing plant bldgs, to Pittsburgh Industrial Engineering Co, 3939 Butler St, Pittsburgh. Est $500,000 to $1,000,000.

Pennsylvania — Industrial Co awarded contract constructing power plant, to Rust Engrg Co, Clark Bldg, Pittsburgh.

Pa., Erie—Erie Lighting Co, 20 S 10 St, awarded contract constructing 3-story, 100x400 ft power plant addn, to Sessinghaus & Ostergaard, Inc, 1115 Peach St. Est $400,000, exclusive of equip.

R. I., Woonsocket—Woonsocket Rayon Co, Clinton St, awarded contract constructing 45x50 ft brick boiler plant, 50 ft high to Brien Bldg Co, Inc, 26 Clinton.

Texas—Industrial Co awarded general contract constructing plant to Austin Bridge Co, c/o C R Moore, 1813 Clarence St, Dallas. $8,500,000. Total est $14,850,000. Defense Plant Corp will finance.

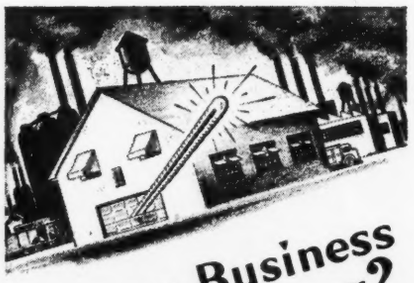
Texas—Industrial Co awarded contract constructing new unit of expansion tin smelter plant, to Ford, Bacon & Davis, Santa Fe Bldg, Galveston, $7,000,000. N V Billiton-Maastchapij, c/o Van De Brock, 10 Rockfeller Plaza, New York, N. Y. will operate. Reconstruction Finance Corp will finance.

Texas—Industrial Co awarded contract constructing plant, incl drainage, 6,000 ft railroad trackage, asphalt roads, etc, to Foster-Wheeler Corp, 165 Bway, New York, N. Y. Est. $6,000,000.

Texas—Industrial Co awarded contract constructing refinery-plant addn, to J E Morgan & Sons, 210 N Campbell St, El Paso, Est $2,650,000.

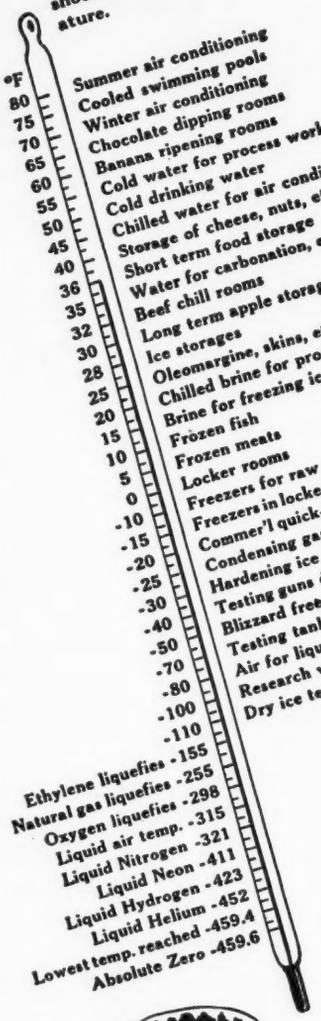
Texas—U S Engrs, Citizens Bank Bldg, Denison, awarded contract for boilers, etc for plant, to Erie City Iron Wks, 1422 East Ave, Erie, Pa., and A M Lockett & Co, Ltd, Magnolia Bldg, Dallas, approx $1,600,000. Freese & Nichols, Capps Bldg, Fort Worth, archts and engrs.

Wisconsin—U S Eng, Baraboo, awarded contract for filters and piping for water filter plant and pump sta, to Pitt Constr Co, Inc, 1235 Washington Blvd, Pittsburgh, Pa.



Is your Business carrying a fever?

Check the temperature at which your place operates with those on this chart. See what can be done with proper refrigeration. Perhaps your business should be carrying a lower temperature.



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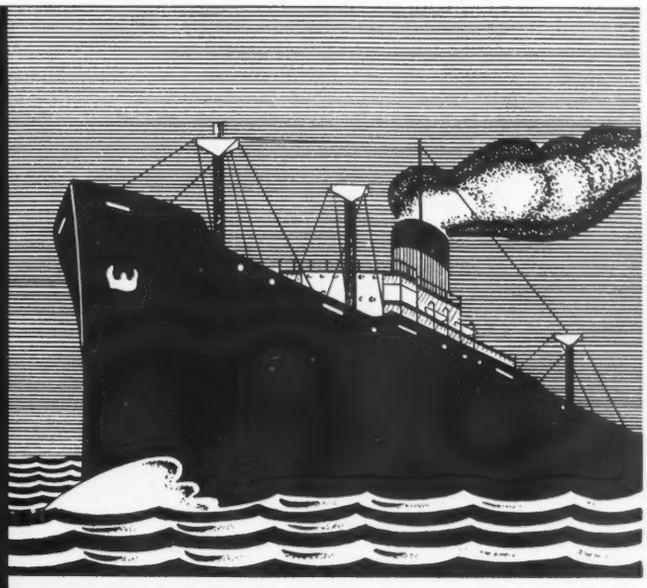

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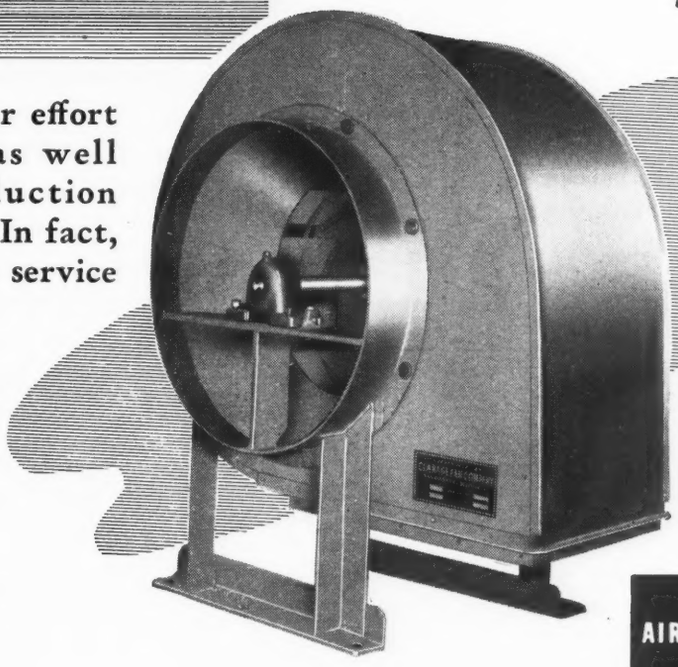
and Every Other Air-Handling Service

Clarage serves the war effort on the seven seas, as well as in the vital production plants of this Nation. In fact, Clarage Fans were in service on many a warship and freighter that helped produce Victory in World War One. *And today we're repeating the performance* – with greatly increased manufacturing and engineering facilities.



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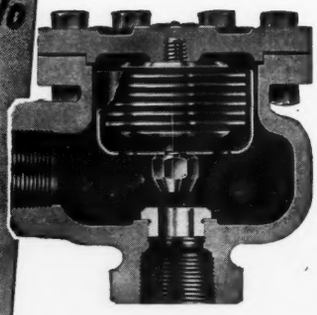

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Frequent intermittent discharge of condensate creates better circulation of steam in water heaters, pipe coils, kettles, driers, unit heaters and other equipment, thus inducing rapid heat transfer. Many reports show the installation of Nicholson Industrial Traps have stepped up production of heated units as much as 30 per cent.

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MAGNOLIA BEARING METALS

Engineers Books

(*Continued from page* 130)

solution, electrical characteristics of cables, machine characteristics, power-system stability—basic elements of theory and application, system stability—examples of calculation, relay and circuit-breaker applications, wave propagation on transmission lines, lightning phenomena, line design based on direct stroke, insulation coordination, power-system voltages and currents during abnormal conditions, power transformers and reactors, grounding of power-system neutrals, lamp flicker on power systems, coordination of power and communication systems. Much of the data and experiences reported in this book are the results of many tests on power lines made possible by cooperation of the large power companies. This book is written by electrical engineers for electrical engineers, and for those concerned with these problems it contains a wealth of information.

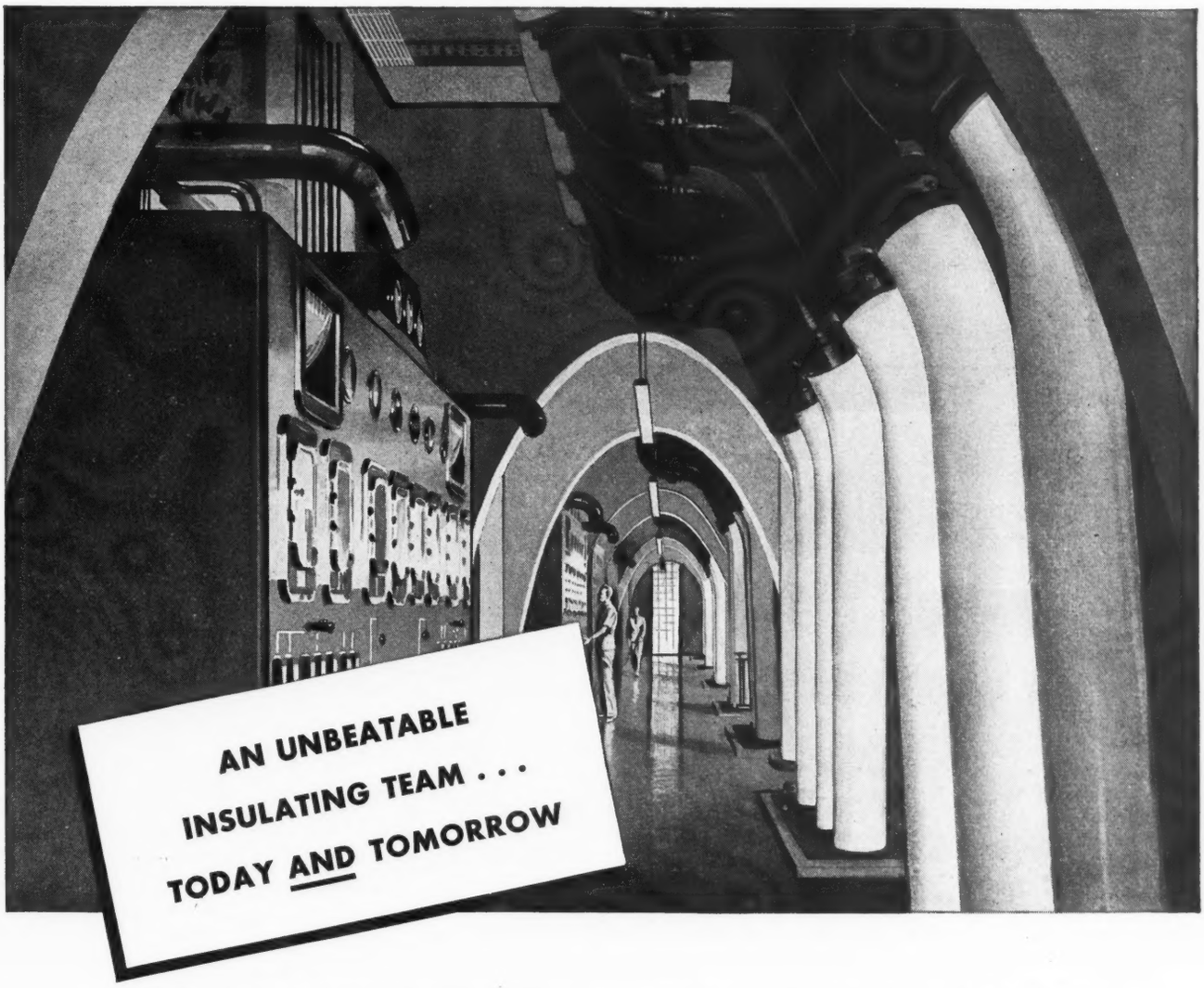
Marine Engineering

THE MARINE POWER PLANT (Second Edition—1942)—*By Lawrence B Chapman, Professor of Marine Transportation and Marine Engineering, Massachusetts Institute of Technology. Published by McGraw-Hill Book Co,* 330 *West* 42*nd St, New York, N. Y.* 401 *pages,* 6x9 *in., cloth bound, illustrated. Price* $4.

Extensive revision and addition has brought this fundamental text on marine propulsion up to date. More attention has been given to fuel oils and their combustion, geared turbines and feedwater treatment than in the earlier edition. Separate chapters cover marine boilers, reciprocating steam engines, geared turbines, turbine-electric drive and diesel propulsion. Other chapters explain the details of marine auxiliaries, condensers, feedwater heaters and efficiency computations.

Under present wartime incentives for shore-based engineers to apply for marine posts, this book affords an excellent basis for refreshing and bringing up to date knowledge of modern ship-popolsion equipment. Dealing, as it does, with the several prime movers now being installed in Maritime Commission vessels, this book will be of definite help in equipping operators for sea duty. While calculations and formulas are prominent in the text, an understanding of the machinery and fundamentals can be had without an extensive mathematical background.

Looking ahead with Asbestos



● It will be most difficult for tomorrow's power engineers to find an insulating team that will match the efficiency of Keasbey & Mattison's "Featherweight" 85% Magnesia and Hy-Temp Insulations.

Used singly or in combination, these two great heat and money saving insulations cover a wide range of temperature conditions, ranging from 212°F. to 1900°F. Few other materials, if any, can match their qualities of lightness, strength and economy . . . their indifference to long submersion in water . . . their ability to hold heat-loss to an absolute minimum.

Helping now to make America unbeatable, it may be difficult for some customers to get K&M 85% Magnesia and Hy-Temp Insulations for the duration. When the war is over, however, both of these industry essentials will again be available in large quantities, along with other new and improved asbestos products which K&M research promises to reveal.

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asbestos-cement shingles and wallboards; asbestos and magnesia insulations for pipes, boilers, furnaces; asbestos textiles; asbestos electrical materials; asbestos paper and millboard; asbestos marine insulations; asbestos acoustical material; asbestos packings; asbestos corrugated sheathing and flat lumbers; asbestos-cement pipe for water mains

a new way

TO LIGHT OFF BURNERS THAT'S FASTER-SAFER-MORE POSITIVE

ENCO AUTOMATIC RETRACTABLE OIL-ELECTRIC IGNITION SYSTEM

for lighting off PULVERIZED COAL-OIL-GAS BURNERS WITH REMOTE CONTROL

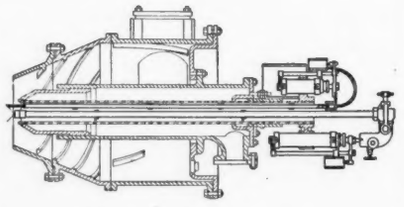
LOSS of ignition for even a short time in a large steam generating unit may, and frequently does have serious results. Turbine operation may be affected, production halted, and process work ruined.

With the Enco Ignition System, the operator can light off any burner by movement of a Hand Control Valve, located close to the pulverized coal mill and fan controls, and within view of the instrument board. Automatically, a powerful ignition spark is established, and the light fuel turned on. Both are interlocked electrically—the oil valve cannot be opened until the spark current is on and the atomizer is in firing position. After the oil flame is established, a second movement of the control valve retracts the electrodes, leaving the atomizer in operation.

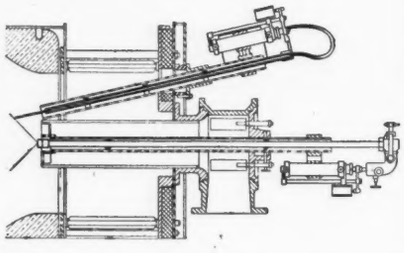
After ignition of the pulverized coal is established, a third movement of the control valve shuts off the oil and retracts the atomizer out of the hot zone leaving the unit ready to repeat the operation as may be needed.

The Enco Ignition System has a wide range of application. Pulverized coal, blast furnace gas or any liquid fuel may be ignited by the unit or the spark alone may be used to ignite natural or refinery gas. The ignition flame can be gradually changed from light to heavy fuel oil if continued operation under heavy load is required. The ignition flame can also be used as a substitute for principal fuel in emergencies.

Send for illustrated booklet describing the equipment, its operation, and how it can be installed in your burners.



Application where atomizer and electrodes are inserted in the central tube.



Application where atomizer and electrodes are inserted in separate tubes.

THE ENGINEER COMPANY
75 West Street • New York, N. Y.

Enco OIL BURNING EQUIPMENT

HANDBOOK OF SHIP CALCULATIONS, CONSTRUCTION AND OPERATION (Third Edition, 1942)—*By Charles H Hughes, naval architect and engineer. Published by McGraw-Hill Book Co, 330 West 42nd St, New York, N. Y. 558 pages, 5x7 in., flexible binding. Price* $5.

Practical data for men engaged in designing, building and operating ships. Includes data on overhauling boilers, indicator-card calculations, operation of pumps, condensers and motors, for the marine operating engineer. Brief descriptions of modern vessel types have been included. Information and tables on ventilation and refrigerating systems of ships, bilge and ballast systems, sanitary and fire-detecting equipment, steering gear, winches, and stowage of cargo will interest marine operators of all classifications.

PRACTICAL MARINE DIESEL ENGINEERING (Third Edition, 1942)—*By L R Ford, Editor, Motorship. Published by Simmons-Boardman Publishing Corp, 30 Church St, New York, N. Y. 590 pages, 6x9½ in., illustrations, charts, tables, cloth binding. Price* $5.00.

Contains a straightforward and practical discussion of construction, operation and maintenance of marine diesel engines. Covers new developments such as hydraulic and magnetic couplings and superchargers. This third edition is limited to American engines.

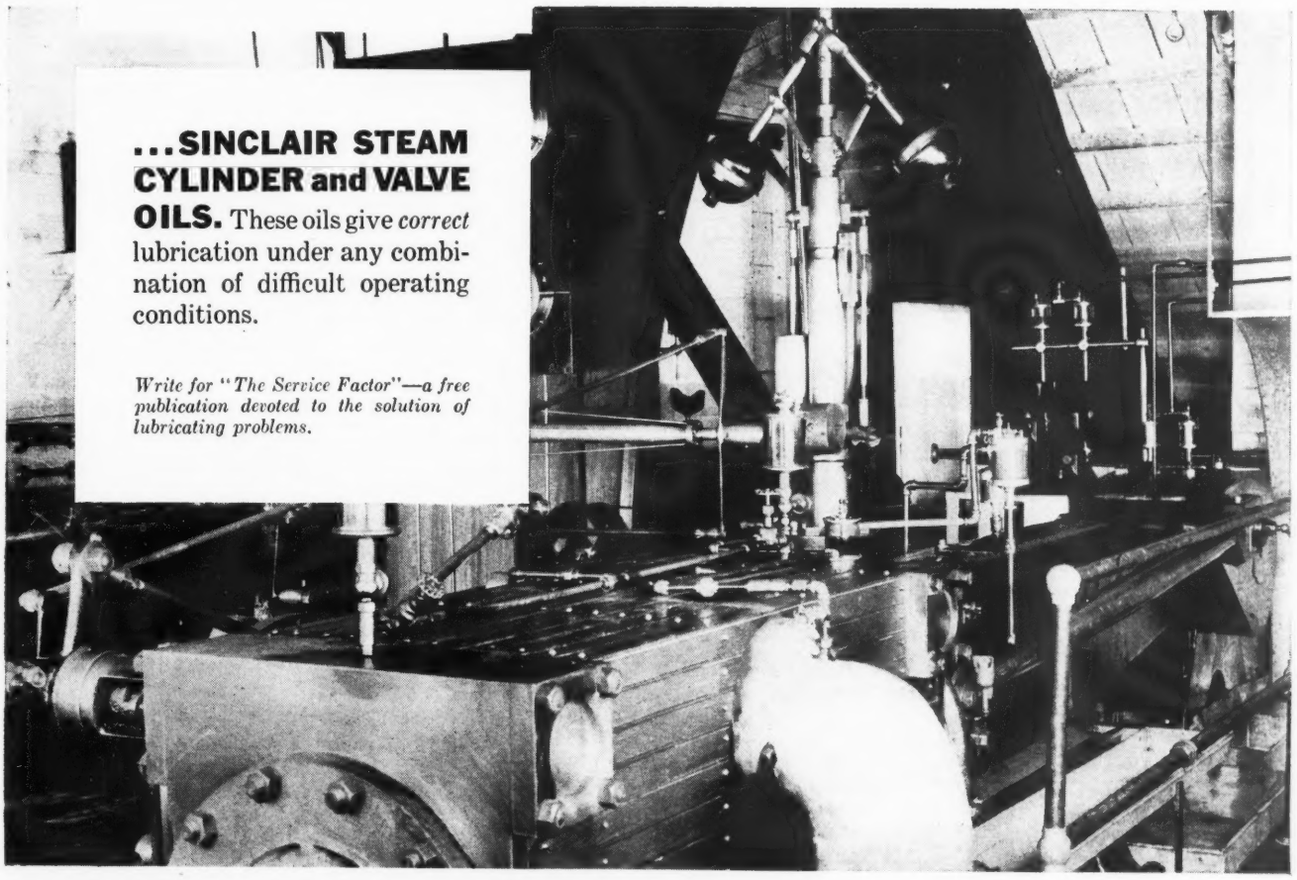
Chapters on methods and requirements for obtaining a motorship license will prove particularly interesting to stationary operators who want to take an active part in the "battle of transportation" by putting their experience and knowledge at the service of our rapidly expanding merchant marine.

Control

AN INTRODUCTION TO CONTROL ENGINEERING (1942)—*By E S Smith, Patent Agent, C J Tagliabue Mfg Co. Published by E S Smith, 114-57 176th St, St Albans, L. I., N. Y. 135 pages, 8x11 in., illustrated, paper cover. Price* $2.00.

This book, in typewritten form, is based on lectures by the author at Pratt Institute, Brooklyn, N. Y., given as part of an engineering, science management and defense training course in engineering instruments. It is divided into four principal parts: introduction to control, quantitative analysis of control, various aspects of control and an extensive bibliography of literature on instruments and control. The pre-

POWER TO WIN depends on horsepower. For development of full designed power output from *STEAM ENGINES* use . . .



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DAVIS CONTROLS for Liquid Level

No. 60
FLOAT VALVE

For float valve dependability, the Davis No. 60 is unexcelled. It features Davis' pilot-stem, single seat, tight-closing valve. Standard sizes will open against any pressure up to 125 lbs. No internal packing! Renewable disc. Hot or cold liquid handled without hunting or water-hammer. All sizes. Globe or angle body patterns.

ENGINEERS interested in working out the best possible fluid level and flow control hook-ups will find a wide choice of units offered in the Davis line of float boxes, float valves, fluid control valves, etc. In addition to all standard types of units, Davis has developed a number of special designs that offer exclusive advantages for specific types of service. We will be glad to receive your inquiry and make recommendations on equipment to fit your particular needs. Tell us your problems.

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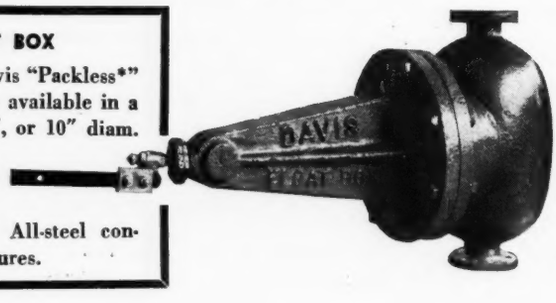
VALVE is an ideal valve for use with any type of float arm. It features the famous Davis single seated, pilot-stem valve: no sticking, no hunting, no water-hammer, no internal packing. Tight closing renewable valve disc. Sizes from ½" to 12" in globe or angle pattern.

No. 168D FLOAT & LEVER UNIT

The DAVIS No. 168D Float and Lever unit is for installation directly in tanks not subject to excessive turbulence or surge. It features the Davis "DIA-BALL" sealed transmission unit*: leakproof, packless, corrosion-resistant, and free from friction. Suitable for pressures up to 200 lbs. and temperatures up to 250°F.
**Patent applied for.*

No. 161D FLOAT BOX

No. 161 D features the Davis "Packless*" diaphragm ball arm and is available in a range of sizes using 6", 8", or 10" diam. floats. Cast semi-steel bodies, with screwed or flanged connections for pressures up to 250 lbs. All-steel construction for higher pressures.



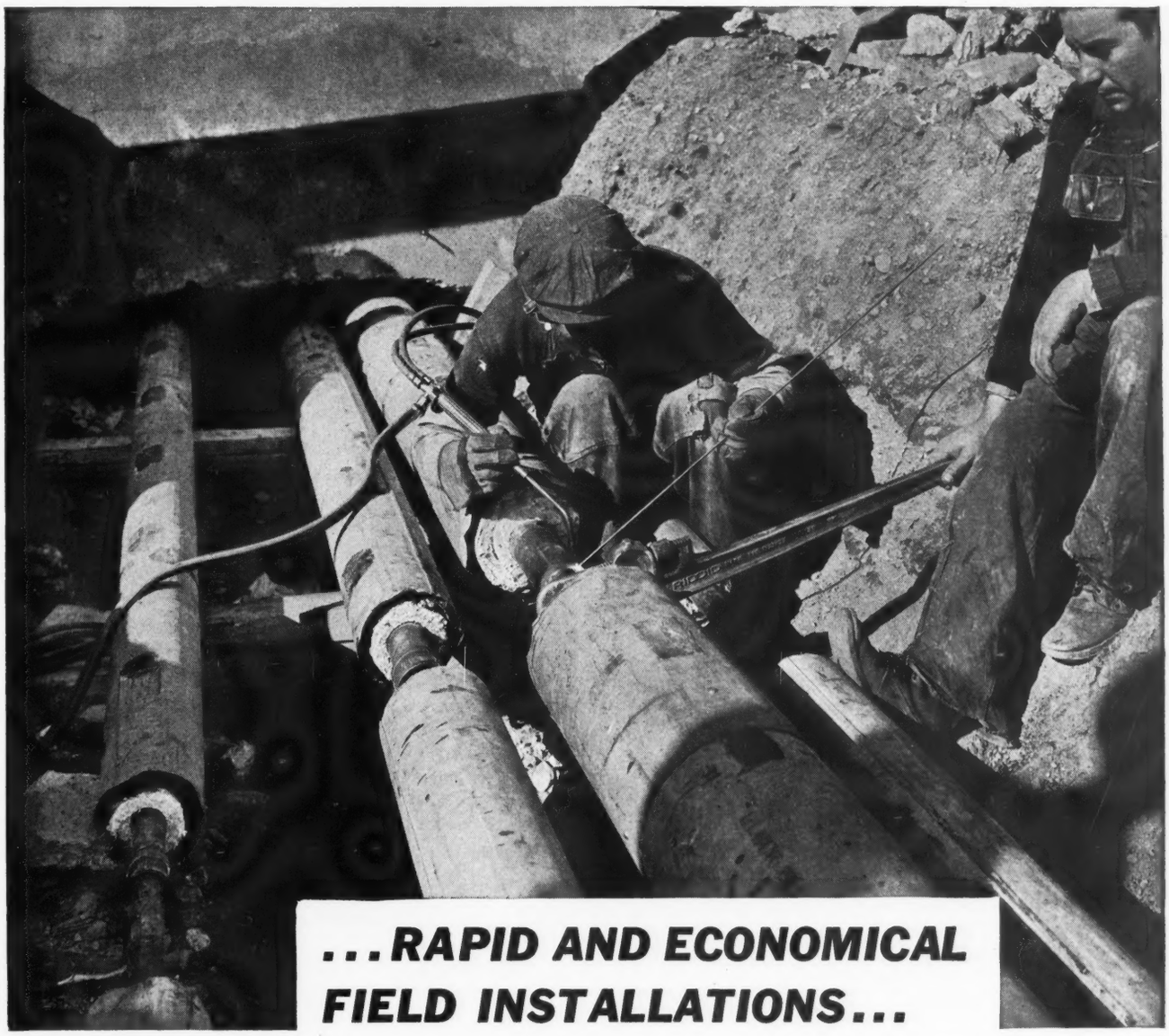
sentation is an attempt to follow a road between purely qualitative and purely quantitative treatment using only sufficient mathematics to give a clear grasp of the physical fundamentals and thereafter relying upon mixture of this with judgment that comes from practical experience. At that, the treatment is too technical except for control engineers who can use their mathematics.

Motors

ELECTRIC MOTORS IN INDUSTRY (First Edition—1942)—*By D R Shoults and C J Rife, edited by T C Johnson, all of the General Electric Co. Published by John Wiley & Sons, Inc, 440 4th Ave, New York, N. Y. 389 pages, 6x9 in., 219 illustrations, cloth binding. Price $4.00.*

Written for industrial engineers, this book deals with those principles of motor applications which are readily understood and which at the same time form the best basis for correct applications. Motors in industry are used in an almost countless number of applications, from driving an electric clock to giant blooming mills in large steel plants. Therefore, in this book the authors have not attempted to cover all applications but have given attention to representative uses. The material is treated under the headings: industrial power supply, physical concepts of motor performance, basic characteristics of induction motors, induction-motor applications, synchronous apparatus, dc motors, industrial-control apparatus, special applications requiring adjustable speed, coordinated drive systems, electronic devices and their principles, and the industrial applications of electron tubes. Types of motors treated include constant-speed dc and adjustable-speed dc with various methods of adjusting the speed; single-phase and poly-phase induction motors; synchronous motors and duosynchronous motors. In the chapter on special applications requiring adjustable speed the drives are divided into two groups: those requiring speed adjustment and continuous operation, such as adjustable-speed paper-machine drives, and multi-frequency machine-tool drive; and drives that involve accelerating duty and slow-speed operation, such as car dumpers, mine hoists and reversing blooming mills. Coordinated drive systems are represented by continuous steel mills and sectionalized paper-machine applications. The book, as stated in the preface, has grown out of a course in

FOR UNDERGROUND PIPE LINES



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Laying underground insulated pipe lines is both rapid and economical when you use the Durant Insulated Piping system. This pre-insulated and pre-sealed system comes to you in completely finished units, ready for installation. No tile or concrete tunnels are required and there is nothing extra to buy. The pipe supports are self-contained and the piping units can be laid with a minimum of trenching and field work. The asphalt protection is permanently water-proof and the 85% Magnesia insulation will maintain its efficiency throughout the years.

Write us today for your copy of the new Ehret 176-page Insulation Handbook, #A202, which describes the D. I. P. system as well as many other Ehret products. *It's free.*

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AS YOU PLAN FOR AFTER VICTORY . . .
Consider the
Experience
BACK OF
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EQUIPMENT
TURBINES . . . BOILERS . . . ENGINES

Partly assembled low pressure wheel for 2500 k.w. condensing turbo-generator. Nominal pitch diameter of the wheel is 48". View shows construction of blading used.

For more than 70 years MURRAY power plant equipment has played an important part in keeping production wheels turning.

★ Today, in cooperation with America's war winning effort, our production is being scheduled to meet high priority needs. When the day does come when a good old purchase order alone can secure equipment, we will be happy indeed to give our full cooperation to those whose priority ratings now preclude the usual prompt MURRAY Service.

In the meantime may we suggest that you send for Bulletins on Turbine-Generator Units so that you can see just what MURRAY experience means.

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industrial engineering given by the General Electric Co for its engineers in training for positions in engineering departments, laboratories and sales organizations of the company and in industry. The book contains a wealth of information for technically trained engineers and engineering students of electric-motor and control applications.

Sheet-Metal Drafting

SHEET - METAL PATTERN DRAFTING (1942)—*By Frank J. O'Rourke. Published by McGraw-Hill Book Company, New York, N. Y. 189 pages, numerous illustrations and layouts, cloth. Price $2.00.*

The author is instructor in sheet-metal pattern drafting in the University Extension Division of the Massachusetts Department of Education, State Teachers College, Fitchburg, Mass. He has produced a good practical book, clearly explaining the principles of laying out sheet-metal work and applying these several principles to a great variety of shapes used in engineering and in architecture.

Recommended Practices for Inspection of Fusion Welding

RECOMMENDED PRACTICES FOR INSPECTION OF FUSION WELDING (tentative) —*A report prepared by the American Welding Society committee appointed to study and recommend standard practices for welding inspection. Published by the American Welding Society, 33 West 39th St., New York, N. Y. Paper binding, 23 pages, 6x9 in. Price 40 cents per copy; discounts for quantities.*

Contains a comprehensive treatment of the many factors involved in the inspection of welds made by the arc and oxyacetylene processes. It includes: qualifications and duties of welding inspectors; inspection and testing of structures; inspecting during construction; shop and field inspections; examination and radiographic inspection. The welding characterictics of both ferrous and non-ferrous metals are covered with a description of the principal types of defects which may be encountered and explanations of how they may be detected and remedied. The qualifications necessary in a good welding inspector are discussed in full detail, making this a condensed, concise textbook for inspectors.

TIME, TUBES *and* TRANSPORT

The importance of Time, irreplaceable element in this war economy, raises the dependability of our marine power plants to a new pinnacle of importance. It is, therefore, significant that Babcock and Wilcox Boiler Tubes in unprecedented tonnage are steaming the seven seas in ships of war and supply. The special need for dependable service aboard ship and the preponderance of B&W Boiler Tubes in this service strongly indicate the advantages of using these tubes ashore as well as afloat.

B&W Seamless Steel Boiler Tubes have been, for more than a quarter century, standard in the construction of the leading marine, stationary, and locomotive boilers. More than 500,000,000 feet have been installed for pressures ranging up to 2500 pounds per square inch (3500 pounds per square inch in experimental installations) and temperatures up to 1100° F.

TA-1202

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HOT FINISHED COLD DRAWN ALLOY STEELS CARBON STEELS

THE BABCOCK & WILCOX TUBE COMPANY, BEAVER FALLS, PA.

ROTO Saves Time

OUTSIDE AND INSIDE every tube you clean

Roto Model 135 air-driven motor with swing-frame head and air valve for one-man operation.

Faster, more effective action inside the tubes, and faster action between tubes. That's what the powerful new Roto Tube Cleaner equipped with a one-man operating air valve gives you. This time and labor-saving cleaner enables the operator quickly to turn the air on and off entirely by himself, not only eliminating a helper but also the inevitable signalling delays between every tube cleaned. Now, when increased power production is so vital and skilled help so scarce, every power plant engineer owes it to himself to write for details of the new time and labor-saving Roto.

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THE PACKING THAT "PACKS ALL"

. . . use it once and
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Here's the universal packing that can be used for any fluid or on any apparatus. One size packs all—economically, efficiently—tightly—simply.

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Distributors Everywhere

Power Lines

(*Continued from page* 128)

hereby revoked. Definition of "tungsten"—the material covered by the order—is broadened to include any substance whatever containing recognizable tungsten in any stage of process, except alloy steel, high-speed steel, tool steel and finished tools.

To encourage production of concentrates, the amendment allows delivery without restriction of ores or concentrates containing less than 20% tungsten, to processes for concentration, or dealers, though no dealer may hold such stocks longer than 60 days. Persons desiring allocation of tungsten must apply for it on Form PD-9-c before the 20th of the month preceding delivery, sending copies to WPB and to the supplier. Form PD-29-d covering inventory and proposed production must accompany Form PD-9-c.

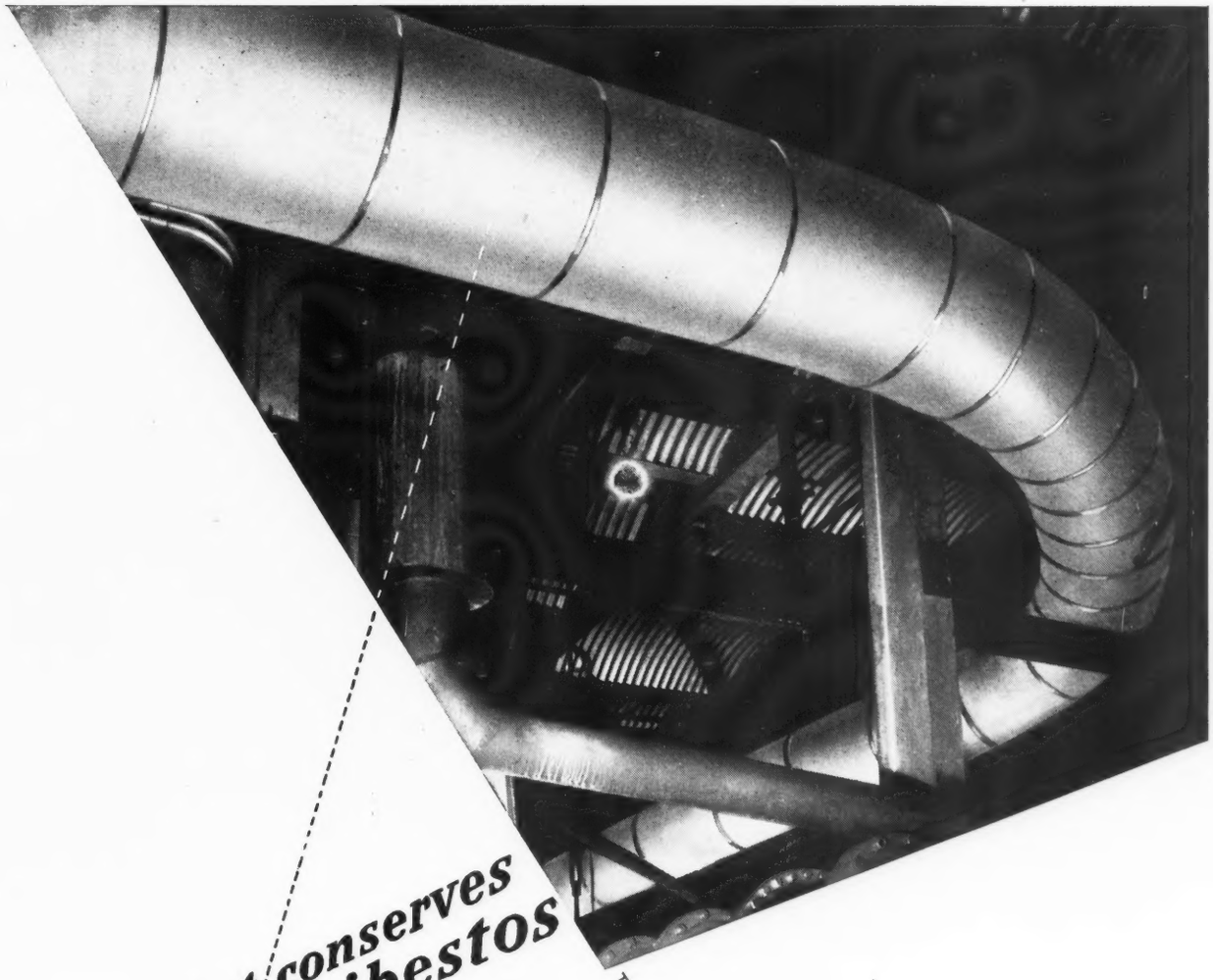
OBITUARIES

CHARLES L MEYER, mechanical and sales engineer with the L J Wing Mfg Co, New York, for the past 18 years, died suddenly on June 26th, at his home, 86-60 Palo Alto Ave, Hollis, L. I.

Born in New York City on August 25th, 1889, Mr Meyer attended Manual Training High School, Pratt Institute and Brooklyn Polytechnic Institute. His first position was with the Brooklyn Edison Co, as engineering assistant, which he held from 1908 to 1910. He worked on power-plant layouts, and in the heating and ventilating field with Westinghouse, Church, Kerr & Co, and was fire-apparatus test engineer for the New York Central and Hudson River Railroad Co, after which he went with the Westinghouse Machine Company, New York, as chief draftsman and engineer.

From 1915 to 1921 he engaged in development, design and maintenance of manufacturing equipment, power plant and buildings for the National Aniline and Chemical Company, manufacturers of die-stuffs and chemicals. In 1922 he was associated with the Alexander Hamilton Institute in New York, handling sales and service, and in 1924 he became sales engineer in charge of sales in the metropolitan district, New York state, Connecticut and New Jersey, for L J Wing Mfg Co.

J ROBERT FORTUNE, senior partner in J R Fortune and Son, died May 23, following a brief illness. He was born



Insulation that conserves war-time B.T.U.'s unibestos

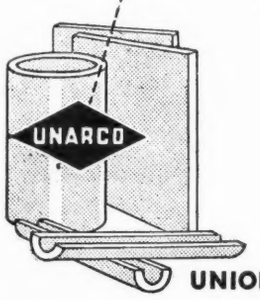
THAT'S THE FORMULA FOR EFFICIENCY IN WAR-TIME INSULATION!

Unibestos has a *permanently low thermal conductivity* —higher thermal efficiency than the most commonly used insulation . . . Three types of Unibestos are available—Standard, with a temperature limit of 750°; Super, with a temperature limit of 1200°, Combination, with a temperature limit of 1200°. These temperature limits permit use of one material at maximum efficiency for a wide range of purposes.

Unibestos is available in half sections up to 30" pipe diameter and from 32" to 60" in quadrants from ¾" to 5" in thickness. Sheets are available in sizes up to 36"x36"x5". Standard and Super material are available in single layer construction with provision for expansion in piping, where required.

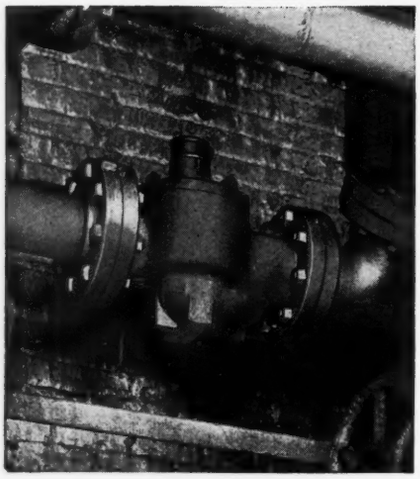
Unibestos won't soften, shatter or shake-down even under severe conditions. It has a resilient, tough and fibrous interior with a hard, smooth finished surface. It is unaffected by vibration.

Write for War Bulletin #PA-48—*"They'll Specify Unibestos"!*



UNION ASBESTOS & RUBBER COMPANY

1821 SOUTH 54TH AVENUE, CICERO, ILLINOIS • NEW YORK: 420 LEXINGTON AVE. • SAN FRANCISCO: 116 NEW MONTGOMERY ST.



HENSZEY

BOILER FEED WATER

METERS

can measure it!

This war of production has brought to light some unusually difficult measuring problems. In many cases the HENSZEY Boiler Feed Water METER has been able to do the job where most ordinary meters failed.

Why? Because the Henszey Meter was developed to measure hot, dirty corrosive boiler blowdown. There are no close clearances to cause trouble. There are a minimum of moving parts. The Henszey Meter is equally accurate at high or low flow, high or low pressure, on reciprocating, duplex, triplex or centrifugal pumps. It can be calibrated to read in gallons, pounds or cubic feet at any specified temperature. Sizes 10 to 600 G.P.M., cold water steady flow rating. Connections: ¾" to 6". Special sizes to order.

HENSZEY COMPANY

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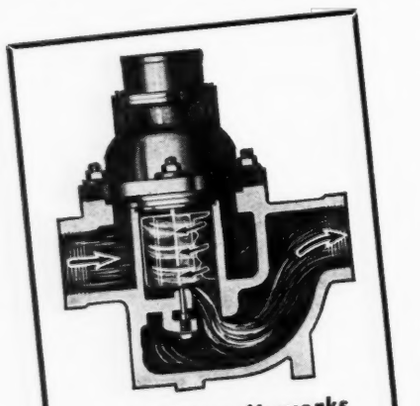


Here's how it works

Water enters the measuring chamber tangentially, spinning in the chamber as it passes through, forming a vortex. Each gallon that passes through this chamber makes the same number of revolutions of the water. A vane is placed in the rotating water to impart this rotation to the register.

HENSZEY

in Detroit and with the exception of a few years lived there all his life.

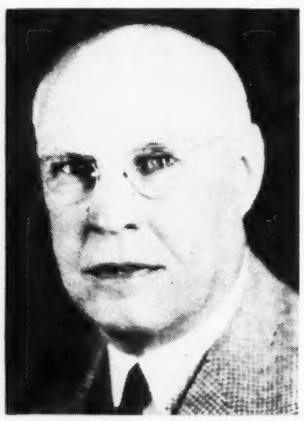
He started his career as a draftsman for the Murphy Iron Works, now Riley Stoker Co, and throughout the rest of his life was intimately connected with development of the mechanical stoker, contributing many basic patents. During these early years one of the few installations of mechanical stokers was at Detroit's only electrical power station, on Washington Blvd, and the chief engineer was a young man named Henry Ford.

In 1900, Mr Fortune went to England as chief engineer of the Underfeed Stoker syndicate, and stayed on as European manager for Murphy Iron Works, returning to this country in 1905 to become their chief engineer. In 1915 he worked with John Dodge, president of Dodge Bros Corp, as engineering advisor on plant extension. During World War I he was efficiency engineer for the American Brakeshoe & Foundry Co's shell plant. The later years of his life were devoted to sales egineering, being associated with Heine Boiler Co and Wickes Boiler Co. In 1932 the partnership with his son, J R Fortune Jr, was formed and continued to his death.

He was a charter member of the Engineering Society of Detroit and has been a member of the former Detroit Engineering Society since 1909.

PERSONALS

MURRAY M BAKER of Peoria, Ill., has been appointed to the newly-created post of executive vice-president, according to an announcement by R G Le-



Tourneau. Mr. Baker enters his new duties immediately, and will make his headquarters at the Peoria plant of R G LeTourneau, Inc.

FRANK J HILL was elected vice-president of Greene Tweed & Co, New York City, manufacturers of Palmetto and other mechanical packings, and special tools, according to a recent announce-

HERCULES

Seamless Copper

FLOATS

GUARANTEED TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

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HENSZEY

BOILER FEED

REGULATORS

GOES IN FEED LINE

The Henszey Boiler Feed Regulator controls boiler water levels continuously and accurately under *all* load conditions!

These simple, compact, self-contained units go right in the feed line and require no additional structural support. They are as easy to install as a simple gate or globe valve. Once installed and set for operation no further attention is necessary—nothing to get out of order—nothing to reset.

Send for latest Bulletin containing full details.

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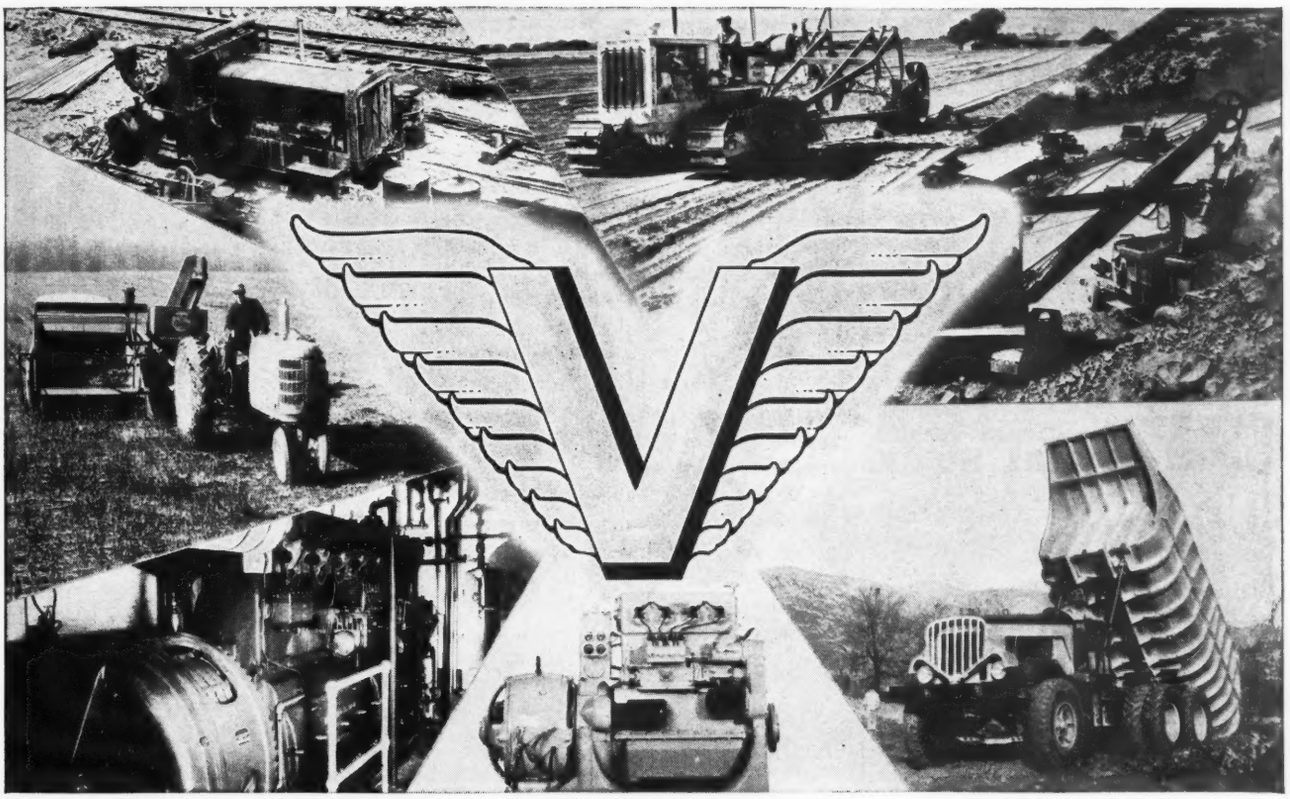
Dept. D8—Watertown, Wis.



Speed Victory

. . . with efficient, non-stop Diesel operation!

TODAY, every Diesel engine owner has his marching orders — *full speed ahead for maximum-production!* That means fewer stoppages, less frequent overhauls. Parts must last longer —even though your engines are driving harder than ever.

There must be no slack, no let-up, no time-out for repairs. For wartime production is a race against Time — and every hour counts!

Your big problem, then, is how to get steady, non-stop operation for longer periods between overhauls.

That's one problem a Cities Service lubrication engineer knows how to handle. Out of long experience, he has the indispensable "know-how" and the exclusive Cities Service instruments with which to tackle your particular job. And he'll be glad to help.

Why not get together with him on a lubrication plan that will keep your Diesels running longer . . . with less time lost for costly repairs? There is no charge for this friendly consultation service. Simply fill in the coupon below and mail it today.

Upon request, an informative, up-to-the-minute booklet, "Diesel Engine Lubrication," will be sent to Diesel operating personnel. Just check the space indicated!

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Room 1326, Sixty Wall Tower, N. Y.
or any of the following offices:
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KANSAS CITY . BOSTON . TORONTO
or to
ARKANSAS FUEL OIL COMPANY
SHREVEPORT . ATLANTA . BIRMINGHAM

Please send me information concerning your Engineers' Lubrication Service. ☐

Please send me your booklet, "Diesel Engine Lubrication." ☐ P.R.

Name_____

Firm Name_____

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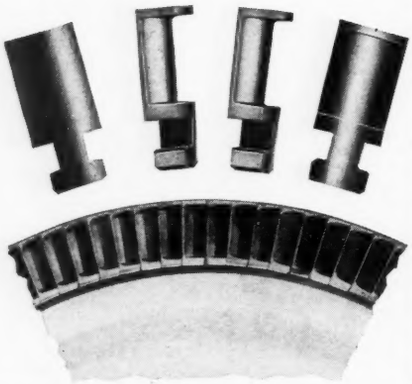
City_____ State_____

A LUBRICANT FOR EVERY INDUSTRIAL NEED



COFFIN — *Steam Turbine* CENTRIFUGAL PUMP

Turbine Blading

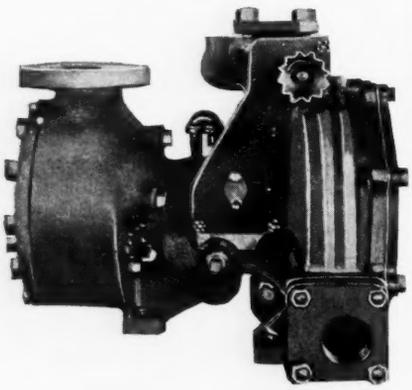
THE steam end of the Coffin Steam Turbine Centrifugal Pump is assured of a long, economical service life by dovetailed renewable buckets with integral shrouds, plus proper bucket speeds. All buckets have a safety factor of 10+ at tripping speeds, and are furnished in either bronze or stainless steel as required by steam conditions.

PRESSURES

To 750 Lbs. Sq. In.

DELIVERIES

To 500 G.P.M.



THE J. S. COFFIN, JR., CO.

ENGLEWOOD, N. J.

ment of the board of directors. Mr Hill has been connected with the company since 1915, and has been its sales manager for many years.

LYNN A WILLIAMS, JR, secretary of Stewart-Warner Corp, and head of the company's legal department, was elected vice-president of the corporation by the board of directors. In his new position he will continue all his former corporation duties. In the nine years that he has been associated with Stewart-Warner, Mr Williams has been affiliated with most of the important steps that the company has taken as part of a long-range expansion program. As a member of the corporation's New Devices Committee, which looks into new production methods and products submitted by inventors, he has been instrumental in the development of many of Stewart-Warner Corp's most successful innovations.

MAURICE HOLLAND, of New York City, was recently appointed industrial research advisor to the F W Dodge Corp, Sweet's Catalog Service Division, according to a recent announcement by C L Williams, vice-president of the corporation. Mr Holland is considered an authority on the gearing of sales and developments of new products and processes, and became well-known to many manufacturers while selling research to industry as director of the National Research Council, Division of Engineering and Industrial Research. He has engaged in other important projects in the technical and research field and has conducted surveys in industrial research, pioneered the formation of the Industrial Research Institute, an organization of the first executives of large and small companies, and is the author of several books on the subject of research in industry.

NEIL C REED of Buffalo, N. Y., has been appointed assistant manager of the $14,000,000 Navy propulsion-equipment plant which Westinghouse Electric & Mfg Co is building in Western Pennsylvania. Prior to his new appointment he was manager of the Buffalo office of Westinghouse Electric Elevator Co. As assistant manager of the new propulsion-equipment plant which Westinghouse will operate for the Navy, Mr Reed will be in charge of engineering, sales and order service, it was announced by F D Newbury, Westinghouse vice-president.

JOHN K KNIGHTON has been appointed director of the wartime "Victory Program" of the national refrigera-

For Example:

CLEANING OIL COOLERS AND PREHEATERS

Keep your lube oil coolers and preheaters operating at top efficiency by periodically removing lime-scale, carbonized oil or other insulating deposits the effective, safe, fast Oakite way as so many other power plants are doing!

You, too, will find the method is easy, economical . . . eliminates need of dismantling equipment . . . saves time and effort. Just circulate recommended Oakite solution through water side or oil side of coolers and preheaters for required period, then rinse. Insulating deposits are thoroughly yet SAFELY removed, so that units are quickly returned to service with normal heat transfer efficiency restored.

FREE on request, a NEW DIGEST gives time-saving tips and work-saving short cuts for handling 28 essential, commonly recurring maintenance jobs. Write for YOUR copy TODAY!

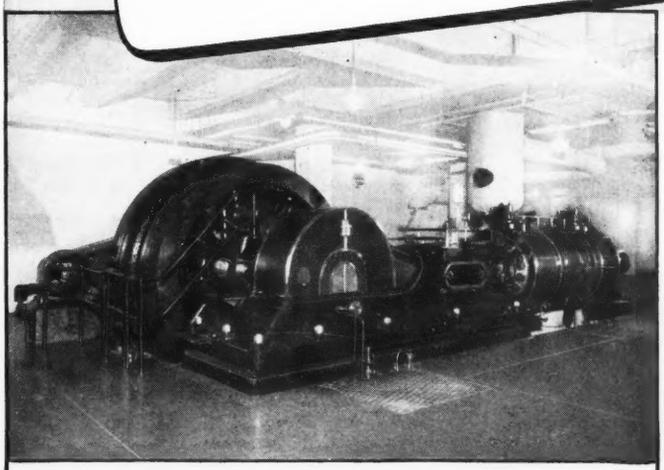
OAKITE PRODUCTS, INC.
23 Thames Street, New York, N. Y.
Representatives in All Principal Cities of the United States and Canada.

OAKITE *Specialized cleaning*
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

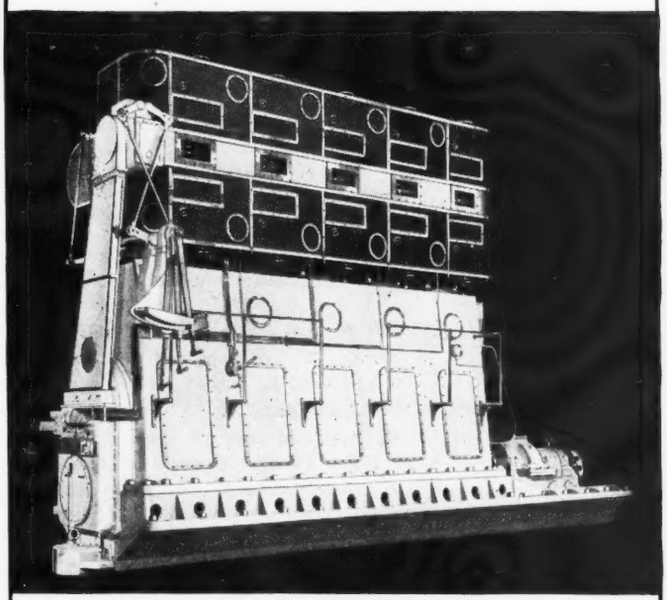
BUILDING STEAM ENGINES

for our armed forces . . .
for our wartime industries

THAT'S OUR JOB



Typical horizontal "Universal Unaflow" engine-generator installation. Multi-cylinder vertical "Universal Unaflow" engines also in general use.



5-cylinder 4,500-shaft horsepower Skinner Marine Unaflow Steam Engine—the largest in the world.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

SKINNER Engines have seen active service with our armed forces before. In World War I, when the A. E. F. needed steam engines, we built them. ***We have a bigger job to do in this war.***

For the duration, the building of Skinner Marine Unaflow Steam Engines is of vital importance. Marine engines are not new to us — in recent years a large part of our plant capacity has been devoted to their production. In peacetime these engines are used for tugboats, ferryboats, lighters, towboats, dredges and other craft of similar size, where economy, simplicity, low maintenance, durability and maneuverability are prime considerations. Now they are being produced as speedily as possible for war service.

Of equal importance is the manufacture of stationary Skinner "Universal Unaflow" Steam Engines, horizontal and multi-cylinder vertical, for the economical and dependable production of electric power, and for driving compressors, pumps and blowers. Large numbers of these engines are now being built, but their availability is of course limited at present to Government service institutions and industries supplying war materials.

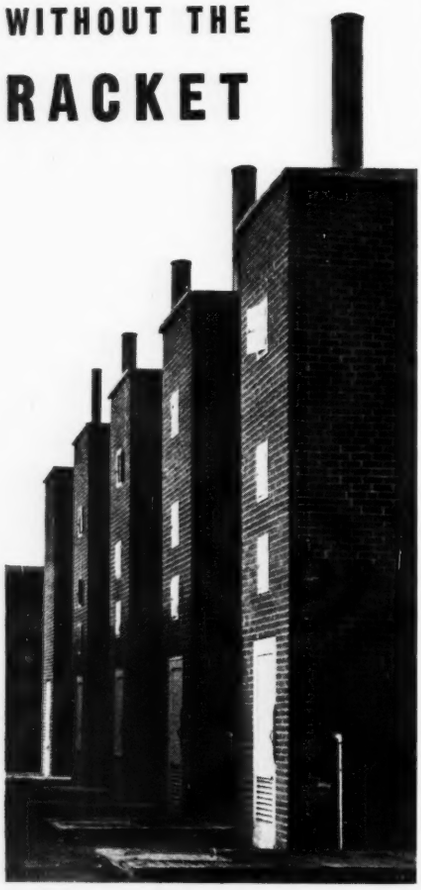
Nor are we forgetting the thousands of industrial plants where Skinner steam engines are already generating power required for the increasing flow of war essentials. Service to these plants will be available at all times.

Building steam engines exclusively has always been our job, but right now we must deliver more of them to help win this war.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

SKINNER ENGINE COMPANY FOUNDED IN 1868 ERIE, PA.

HERE'S POWER WITHOUT THE RACKET



Maxim Silencers make it a simple matter for Power and Lighting Plants to operate their large Diesel Engines without the annoying racket produced by exhaust gases.

Installations on the exhausts of five engines with a total of 900 h.p., in this Virginia plant, effectively silenced them.

The elimination of such noises is not only beneficial to employee morale but often a necessity, when plants are located near residential, school or hospital districts.

Maxim builds silencers for both exhaust and intake of gasoline, fuel-oil, and natural gas engines, as well as for compressor intakes.

Maxim's leadership in this field is your assurance that Maxim Silencers are soundly engineered and constructed for a long life of uninterrupted service, with an absolute minimum of maintenance.

THE MAXIM SILENCER CO.

92 Homestead Ave. Hartford, Conn.

MAXIM SILENCERS

tion and air-conditioning industry, according to an announcement by Dr William R Hainsworth, chairman of the group and president of the American Society of Refrigeration Engineers. Mr Knighton is manager of the air-conditioning division of Servel, Inc. The Victory Program has for its objective aid to the government and the nation in every way possible to help win the war. The program particularly stresses conservation as an effective aid to victory.

P W BURNS is now works manager of the Superior Engine Division plant, located at Springfield, Ohio, according to a recent announcement by the National Supply Company. Mr. Burns brings to his new position a thorough knowledge of factory methods and sys-

tems of production efficiency, gained through many years of experience in shop management. He was for some time associated with Fairbanks, Morse & Co. in various executive positions and after 12 years as works manager of their Beloit, Wisconsin plant he resigned to accept a similar post with the A O Smith Corp of Milwaukee, where he has been until his recent decision to join the National Supply Company.

JOHN M LUPTON recently joined Acheson Colloids Corp as advertising manager. A graduate of the University of Minnesota, Mr Lupton comes from the Robins Conveying Belt Co where he also served as advertising manager.

THOMAS R TAIT, director of the Federal Power Commission's national department of power and chief of its bureau of electrical engineering, has been appointed manager of the Washington office of Chas T Main, Inc, Boston consulting engineers, which has been established in the Barr Building,

To handle 175 g.p.m. of 200 to 500 SSU lube oil against 50 lb. gage from 15 in. Hg. suction at 1750 r.p.m.

New Style **PUMPS** for the New Ships

On many of the ships recently built and now under construction, the methods of handling fuel and lubricating oil have been vastly improved by adoption of the

De Laval-IMO Oil Pump

Its exceptional compactness and its ability to operate directly connected at motor and turbine speeds save space and weight, and greatly simplify the power plant layout. There are only three moving parts; no valves, no gears, no separate bearings, no reciprocating parts. The pump interior is readily accessible.

Ask for Catalog 1-96.

IMO MOVES OIL

IMO PUMP DIVISION
of the
De Laval Steam Turbine Company
Trenton, New Jersey

SAVE AIR... SAVE DOLLARS

WHEN you consider the cost of low pressure air at about 1 H.P. per 100 C.F.M., you will quickly realize the economy of Rockwell Blast Gates—the kind that are air-tight, non-chattering and provide better control of your air lines.

Light, strong, carefully machined to close air-tight, Rockwell Blast Gates are available in all types. They can be made up in aluminum, monel, bronze or other alloy metals to meet your requirements.

Write for catalog 4020, W. S. Rockwell Co., 50 Church Street, New York.

★ Rockwell ★ BLAST GATES

TERRY

AN URGENT MESSAGE ABOUT TERRY TURBINE REPLACEMENT PARTS AND THE WAR EMERGENCY

The coming of active warfare makes it doubly essential that we conserve vital materials to the utmost.

We therefore urge all Terry Turbine users to:

- ★ Refrain from ordering unnecessary replacement parts.
- ★ Repair the old part if possible and make it do.
- ★ Keep spare part supplies down to a minimum.
- ★ And above all things not to overstock.

If all our customers will adhere to this policy, vital materials as well as valuable man hours will be saved for our defense work.

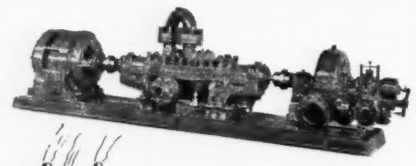
We earnestly solicit your cooperation.

T-1149

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

GOULDS

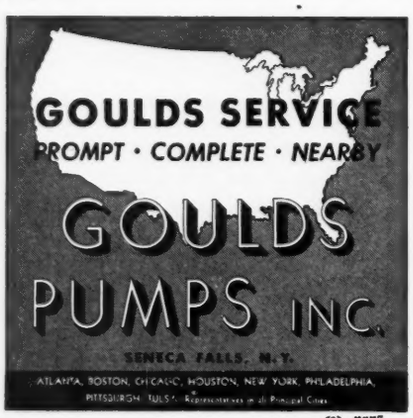
DUAL DRIVE UNIT FOR BOILER FEED ECONOMY



Here's one way to enjoy the economy and protection of optional motor or turbine drive for boiler feed pumps, *without* the cost of a standby unit.

The pump shown above is a Goulds Fig. 3360, 3", 4-stage, high-pressure boiler feed pump rated for 200 GPM feedwater at 220° F. against 1270 ft. head (525 lbs.). In this particular installation, normal drive is from the 100 HP motor. A slip coupling connects pump and turbine. The turbine is used whenever surplus steam is available and also serves as an emergency drive in case of power failure.

If you need new boiler feed units, a modification of this installation might solve several problems. Because Goulds, in the nation's largest pump plant, builds pumps that meet every industrial need, Goulds engineers are equipped to give you prompt, reliable recommendations. There is a Goulds branch office, agent or distributor near you, ready at all times to provide information and service on any pumping problem.



2637

Washington, D. C. For about a decade, Mr Tait has been associated with power resources surveys for the government, in executive engineering capacities.

J K B Hare, manager of the Central District, Westinghouse Electric & Mfg Co, was recently awarded the Westinghouse Order of Merit for distinguished service.

V I Montenyohl, vice-president, The B F Goodrich Co, and a member of the organization for the past 35 years, has resigned because of his health, it is announced by President John L. Collyer. Since 1928 Mr Montenyohl served as a director of the company and has directed the activities of The International B F Goodrich Corp, of which he was president. In recent years he has been responsible for activities of Koroseal, Chemical Sales and Traffic Divisions of the company and was president of the Philadelphia Rubber Works Co.

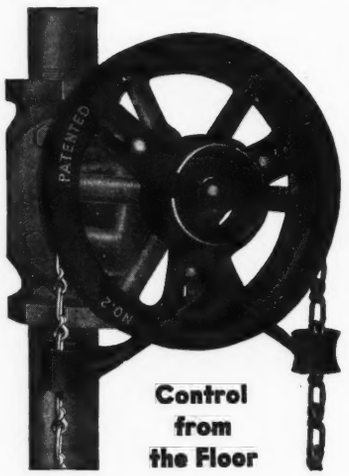
Harry C Beaver has been elected president of Worthington-Gamon Meter Co to succeed the late E T Fishwick. Mr Beaver is also president of the Worthington Pump and Machinery Corp. R R Anderson, treasurer and manager of Worthington-Gamon Meter Co, has been elected vice-president and director and will retain the office of treasurer.

Richard F Bergmann has been appointed chief engineer of Link-Belt Co and will make his headquarters at the executive offices in Chicago. William W Sayers, who has served in this capacity since 1925, has been appointed Consulting Engineer. In this newly created position he will continue to deal with patent matters and be available for consultation where his extensive knowledge of the company's engineering problems will be helpful. Mr Bergmann was assistant to Mr Sayers from 1933 to 1936, when he resigned to become chief engineer of Rayon Machinery Corp, from which position he returns to Link-Belt.

Herman K Eckert, plant manager of the Nitro plant of the Organic Chemicals Division, Monsanto Chemical Co, has been appointed plant manager of the new synthetic-rubber raw-material plant being constructed by Monsanto for the Rubber Reserve Co. Dr Charles S Comstock of the Merrimac Division has been appointed production manager of this new Texas plant.

A L Diederich, Jr, formerly of the Barrett Co, has been appointed assistant

Make Your Overhead Valves SAFE And Easy to Reach---



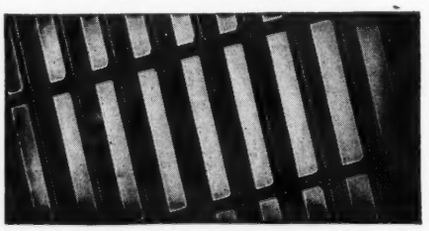
With the Babbitt Rim for Valves you eliminate danger and banish the step-ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.
New Bedford, Mass.

When you need grates

Specify **BATES**

FOR LONG-TIME ECONOMY



FILLET WELD

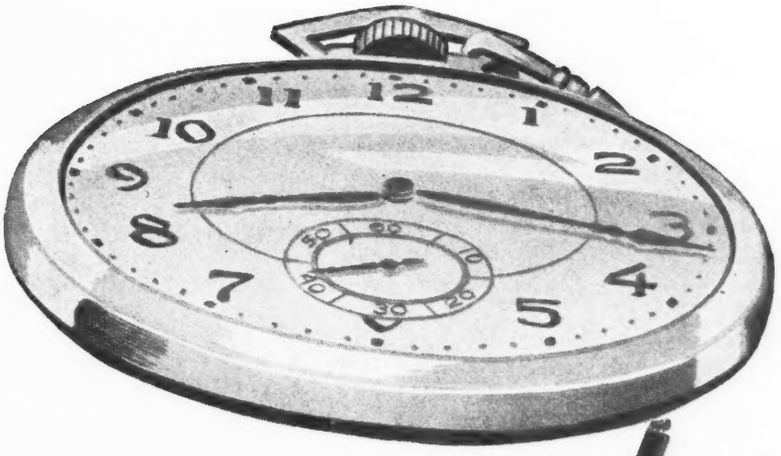
BATESGRATES

—One Piece Construction

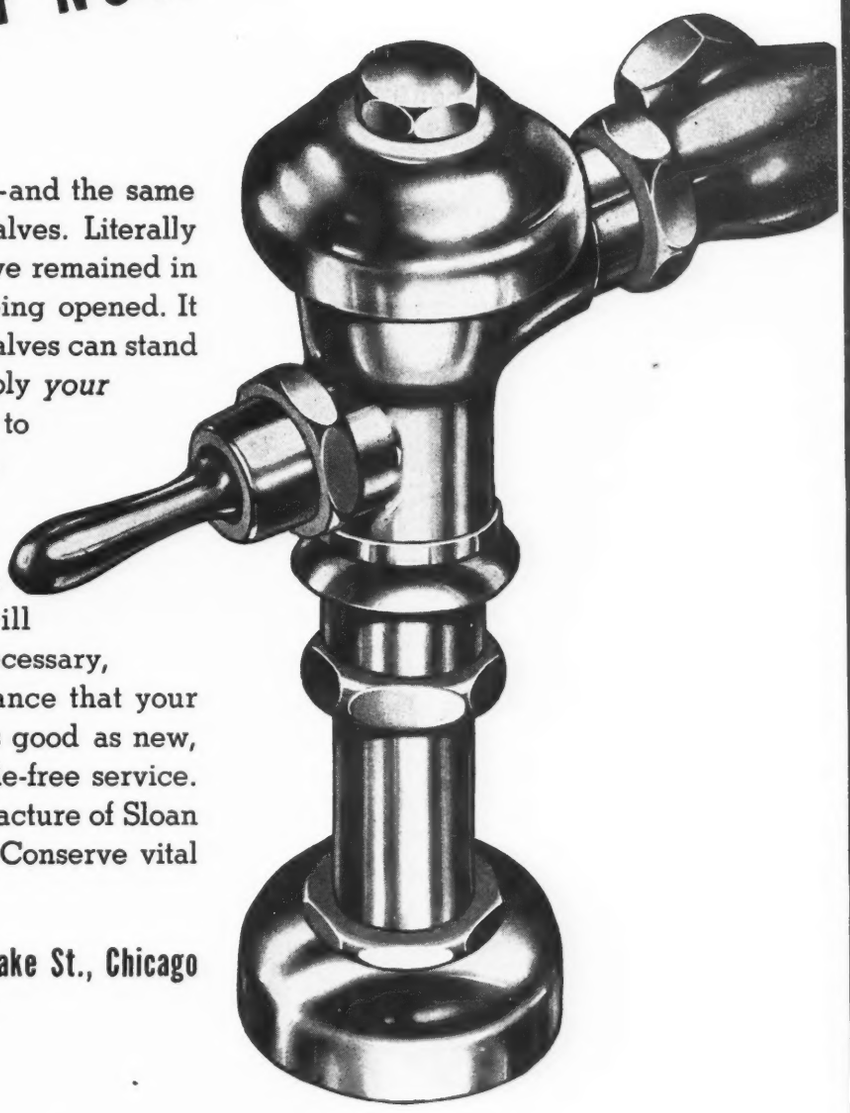
Each intersection ,and consequently, each complete panel of Batesgrates, is strictly one piece. Non-slip, sharp top edge, self cleaning cross bars like the ridge of a roof. No cracks, joints, or acute angles. No grooves to hold grease and dirt and create slippery spots. Batesgrates are an engineered assembly of bars — all bars work.

Write for engineering Catalog No. 937.

WALTER BATES COMPANY
208 S. LaSalle St. Chicago, Ill.



THEY RARELY NEED ATTENTION...BUT THEY DESERVE IT NOW!



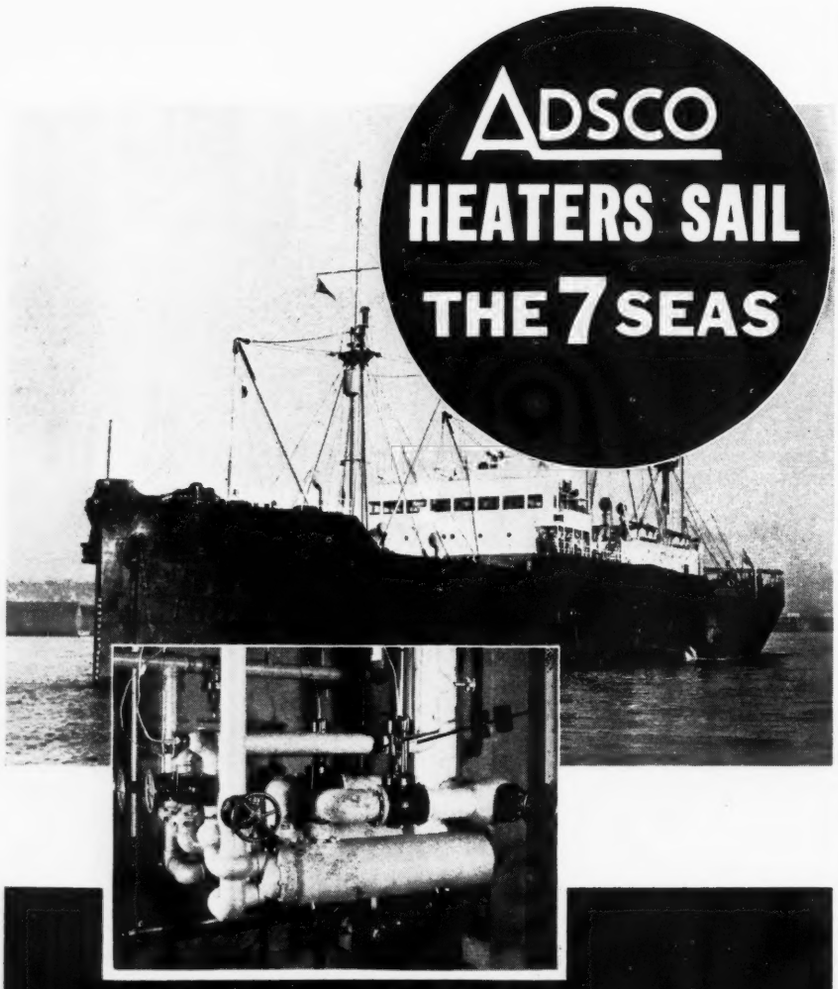
Your watch rarely needs attention—and the same can be said of your Sloan Flush Valves. Literally thousands of Sloan Flush Valves have remained in daily service, *for years,* without being opened. It really is amazing how Sloan Flush Valves can stand years of abuse and neglect. Probably *your* Sloan Flush Valves have continued to operate so efficiently you take them for granted.

Don't do it. Call in a master plumber today and have your Sloan Flush Valves checked over. He will make only the repairs which are necessary, and you will then have the assurance that your every Sloan Flush Valve is again as good as new, ready for more long years of trouble-free service.

Every material used in the manufacture of Sloan Flush Valves is on the critical list. Conserve vital metals by proper maintenance.

SLOAN VALVE COMPANY, 4300 West Lake St., Chicago

SLOAN FLUSH VALVES



STORAGE OR INSTANTANEOUS HEATERS . . . ECONOMIZERS

Built Just Right for your Job

● **America must deliver the goods—and hot water and steam are important requisites to the smooth running of big merchant ships. Here, as in America's large manufacturing plants, institutions, schools, colleges and public buildings, you will find ADSCO Heaters on the job in large numbers.**

Whatever your particular water heating problem, ask ADSCO what type, size, capacity, pressure and construction will best meet your needs.

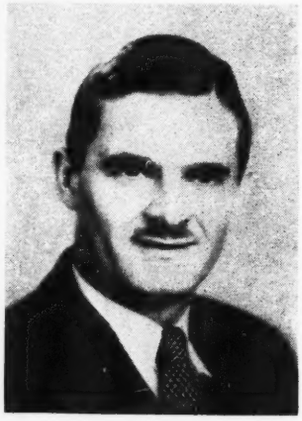
Avail yourself of ADSCO'S long years of experience building practically every size and type of heater—horizontal or vertical—storage or instantaneous—as well as heat economizers and special units to heat or cool oil, water or other liquids.

Get a heater that's built to meet your exact operating conditions. Submit the details—or write for illustrated Bulletins.

AMERICAN DISTRICT STEAM COMPANY NORTH TONAWANDA, N. Y.
Makers of "UP-TO-DATE" Steam Line Equipment For Over 60 Years

o the president. J E Lonergan Co. Philadelphia. manufacturers of safety valves. pressure gages and allied pressure-control devices.

CHARLES A MABEY now directs research activities of the Bristol Co. Waterbury. Conn.. according to a recent company announcement. Mr. Mabey, a Harvard graduate with advanced work in physics at both Harvard and MIT.



has been associated in research work with International Communications Laboratories, Federal Telegraph Co, and Mathieson Alkali Works. He is a member of the American Physical Society.

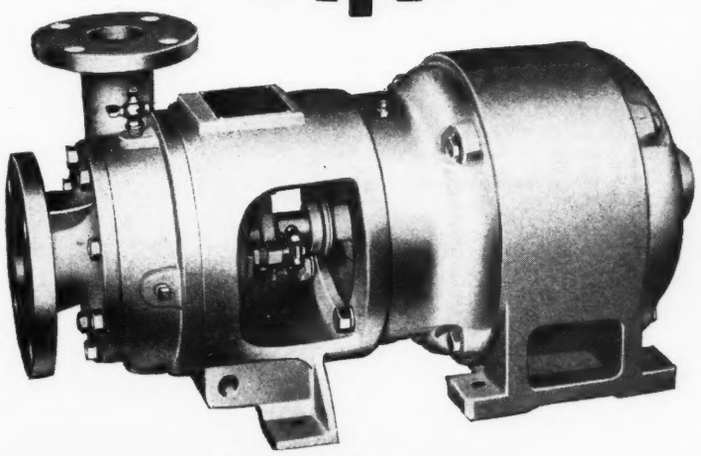
S E LAUER, president of York Ice Machinery Corp, York, Pa., was elected a director of the American Management Association at the recent annual meeting. The election was for a three-year term.

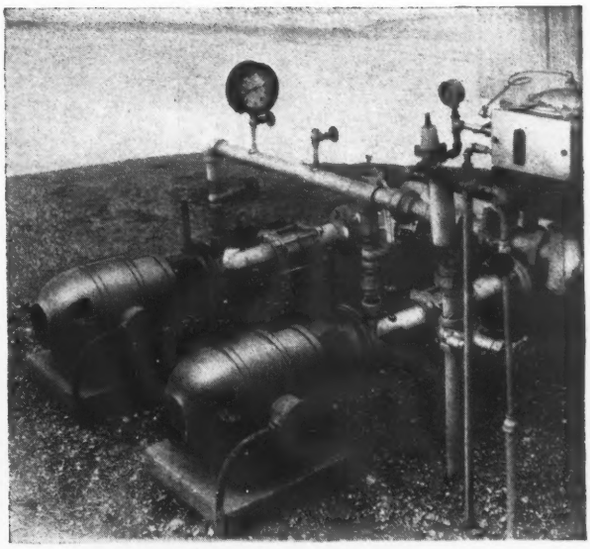
HERMAN W STEINKRAU, formerly vice president and general manager, Bridgeport Brass Co, became president and general manager on May 25.

W S SHIPLEY, chairman of the board, York Ice Machinery Corp, was honored by Northwestern University in recognition of contributions made to the advancement of the refrigeration and air-conditioning industry. He was invited to serve as a member of the Honorary Advisory Committee on the occasion of the dedication of Northwestern's new Technological Institute.

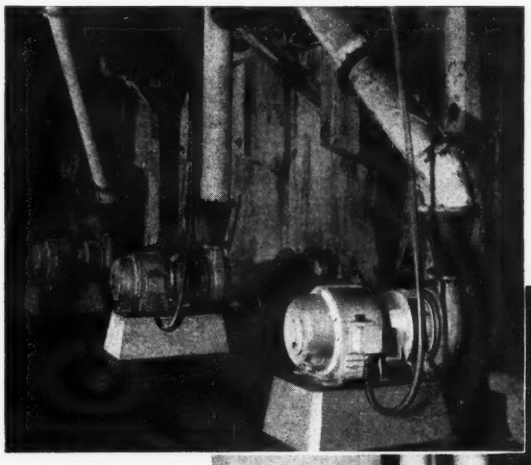
J A DANNER, industrial sales promoter for Standard Oil Company of Indiana's Chicago division retired June 12 under the company's pension plan. Danner began his service with Standard 26½ years ago and has held many important sales jobs. To fill his place, Standard is promoting Harry G Stiles, who, during most of his 20 years experience with the company, has served as an expert counsellor to industrial plants on lubrication problems.

The MOTORPUMP

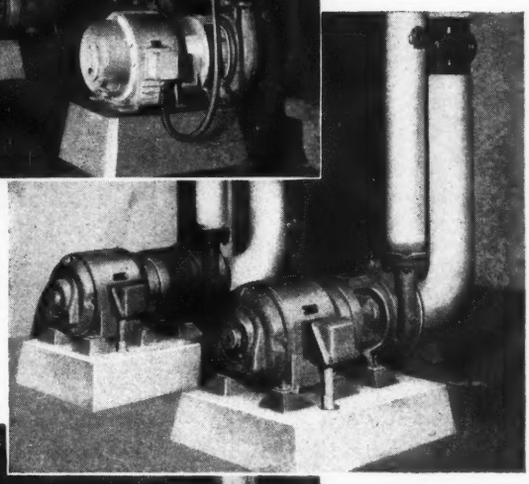




Handling gasoline.



Handling paper stock.



Handling hot water.

Handling mine water.

Will handle YOUR TOUGH JOBS

The Motorpump is sturdy and rigid and therefore can be mounted in any position without a baseplate. Its extra-heavy shaft aud bearings assure freedom from vibration, long stuffing-box life and low maintenance expense. These and similar attention to other important details mean that you can put the Motorpump on your toughest job with the utmost confidence.

And remember, because the Motorpump is built to handle the toughest kind of pumping jobs, it will handle normal jobs with ease.

These units are available in capacities from 5 to 1800 gpm heads to 500 ft.

Ingersoll-Rand

Cameron Pump Division
11 Broadway, New York, N. Y.

9-164

DON'T DELAY!

Search Your Plant Today FOR USED DART UNIONS

. . . And put them back to work to conserve vital metals

The search is on—in plants all over the country—to find used or discarded Dart Unions. For *two* reasons. First, old Dart Unions now *belong* back on the job and will work as efficiently as ever. Second, by putting used Darts back to work, you help conserve vital metals.

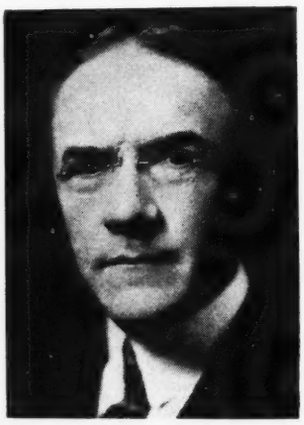
The explanation of why a Dart Union can be used so many times, with absolute assurance of tightness each time, is found in the way Darts are made. Darts have two extra-wide, non-corroding bronze seats, ground to "true-ball" surfaces. And, the nuts and bodies of all Dart Unions are made of High-Test Air Refined Malleable Iron that resists pipe strains, rough handling, rust.

So we say again: don't delay . . . search your plant for used Dart Unions *today*. If you also need *new* Darts, see your supplier.

DART UNIONS

E. M. DART MFG. CO., Providence, R. I.

HOWARD N EAVENSON, Pittsburgh mining engineer and consultant, has been re-elected president of Bituminous Coal Research, Inc, the research agency of the bituminous coal industry and affiliate of the National Coal Associa-

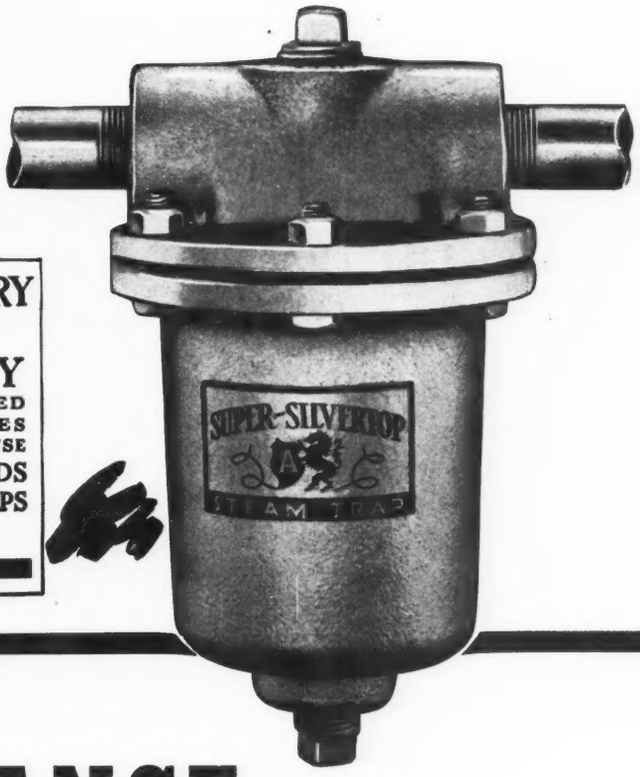


tion. Two new directors, W C Hull, vice-president, Chesapeake & Ohio Railway, and K A Spencer, vice-president, Pittsburgh and Midway Coal Mining Co, have been named by the stockholders. All other directors and officers are being continued in office.

WILLIAM M BLACK was made a vice-president of the American Brake Shoe and Foundry Co at a recent meeting of the board of directors, according to an announcement by W B Given Jr, President. Mr Black has been president

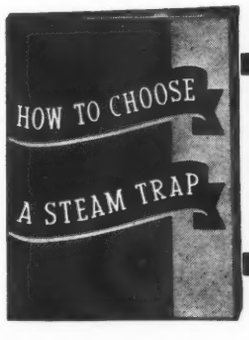
of the American Manganese Steel Division of American Brake Shoe and Foundry Co since 1940 and will continue in that capacity. He joined this division in 1912 and became its general sales manager in 1934 and vice-president in 1935. Mr Black served as a lieutenant of ordnance in World War I.

GEORGE B BOTFIELD has been appointed assistant vice-president of the Botfield Refractories Co, Philadelphia, manufacturers of Adamant firebrick cement and other refractories products. Mr Botfield will be in charge of the Pittsburgh territory, making his head-



IMPORTANCE of Super-Silvertops in wartime

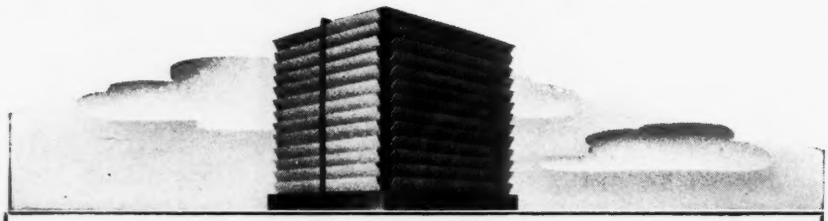
Anderson's Super-Silvertop Steam Traps are playing their part in helping to win the war. Thousands of these dependable inverted bucket traps are being selected for installation in war production plants because in peace times they definitely proved their dependability in giving uninterrupted, economical service in trapping steam-using equipment. Only Super-Silvertop Steam Traps are distinguished by these three advantages. First, simplified piping; they are used as an elbow or straight-in-line—Second, extra capacity due to a larger guided bucket—Third, passages liberal in area and bored smooth; not narrow cored passages to become clogged with scale and interrupt the flow of condensate. Now is a good time to become acquainted with Super-Silvertop Steam Traps. The way to become acquainted is to send for the book, "How to Choose A Steam Trap" a manual on the selection, installation and operation of steam traps. A letter from you brings a complimentary copy.



SEND FOR THIS BOOK NOW

THE V. D. ANDERSON COMPANY
1934 WEST 96TH STREET • CLEVELAND, OHIO

4 Steps to More Efficient Slime and Algae Control



By JOHN D. FLEMING, Sales Development Department
MONSANTO CHEMICAL COMPANY

BECAUSE supplies of both chlorine and phenol, the raw materials from which Santobrite (sodium pentachlorophenate) is manufactured, are critically tight, it is essential that the most efficient possible use be made of every ounce of Santobrite.

These four steps are urgently recommended, therefore, to determine the smallest dosage of Santobrite you can use and still keep slime and algae formations from building up on the heat transfer surfaces of your system:

1. Establish in the circulating water system a concentration of about 40 p.p.m. of Santobrite. (Standard types of wet or dry feed mechanisms can be used but Santobrite can be introduced by hanging one-ounce briquettes in a wire basket in a circulating water passage where they will dissolve gradually.)
2. Maintain the concentration of 40 p. p. m. for about 10 to 15 days, which is usually long enough to completely kill and remove any existing slime and algae deposits.
3. Gradually *reduce* the chemical concentration for 15 to 20 days until the algae growth just reappears. Then *increase* the concentration by about 5 p. p. m. and maintain at this figure.
4. Maintain the minimum effective concentration thus determined by daily or semi-daily additions.

Experience has indicated that about 20 parts per million of Santobrite will effectively control slime and algae in the average system, but the exact dosage for any specific system depends on the types of organisms found there, the extent of contamination and environmental factors. Only by the four steps outlined above can it be accurately determined.

As for the cost of Santobrite treatment, on several large industrial systems it has averaged about 40 cents per million gallons of water circulated. In one typical cooling tower system serving a 55-ton Freon air-conditioning installation, the total cost for an average season from April to November was less than $5. Since the application of Santobrite requires no special equipment and very little labor or supervision, the principal cost of treatment is the chemical itself.

Santobrite is adapted to use in practically all industrial water plants where the water is not used for drinking or bathing purposes. It is effective and economical in most recirculating cooling water systems. For full information on how, when, where and how much Santobrite to use for best results, write today for Monsanto Technical Bulletin 0-15. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, St. Louis, Missouri.

MONSANTO CHEMICALS

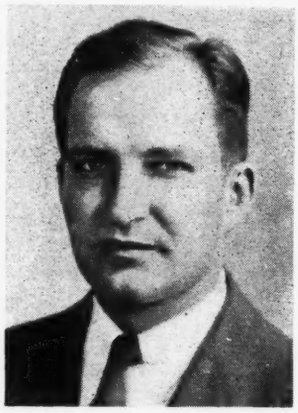
"E" for Excellence . . . The Navy "E"—denoting the highest service accomplishments of the United States Navy—awarded to Monsanto, December 31, 1941, "in recognition of production of ordnance materiel vital to our national defense."

SANTOBRITE
for Slime and Algae Control

SERVING INDUSTRY . . . WHICH SERVES MANKIND

quarters with the Pittsburgh Supply Co, the Adaproducts distributor in that territory.

L A KUNZLER, who has been with Elliott Co since 1935 and has been located in the Tulsa office for the past four years, has been made field manager of the tube-cleaner department at



Springfield, Ohio. After spending some time at headquarters on development plants for tube cleaners and cutting heads, Mr Kunzler will devote the greater part of his time to traveling in the interest of tube-cleaner applications in both refineries and industrial power plants.

BUSINESS ITEMS

HYGRADE SYLVANIA CORP stockholders were asked at a special meeting July 21. to consider a change in the corporate name to Sylvania Products, Inc. The change was approved by the officers and directors of the company. It will not affect basic operations or policies. but is described as a step in the company's long-term program in preparation for post-war developments. The corporation is the third largest manufacturer of incandescent lamps. the second largest manufacturer of radio tubes. the third largest producer in the fluorescent lighting field. and it is believed that the proposed change will establish a single distinctive name in the public mind.

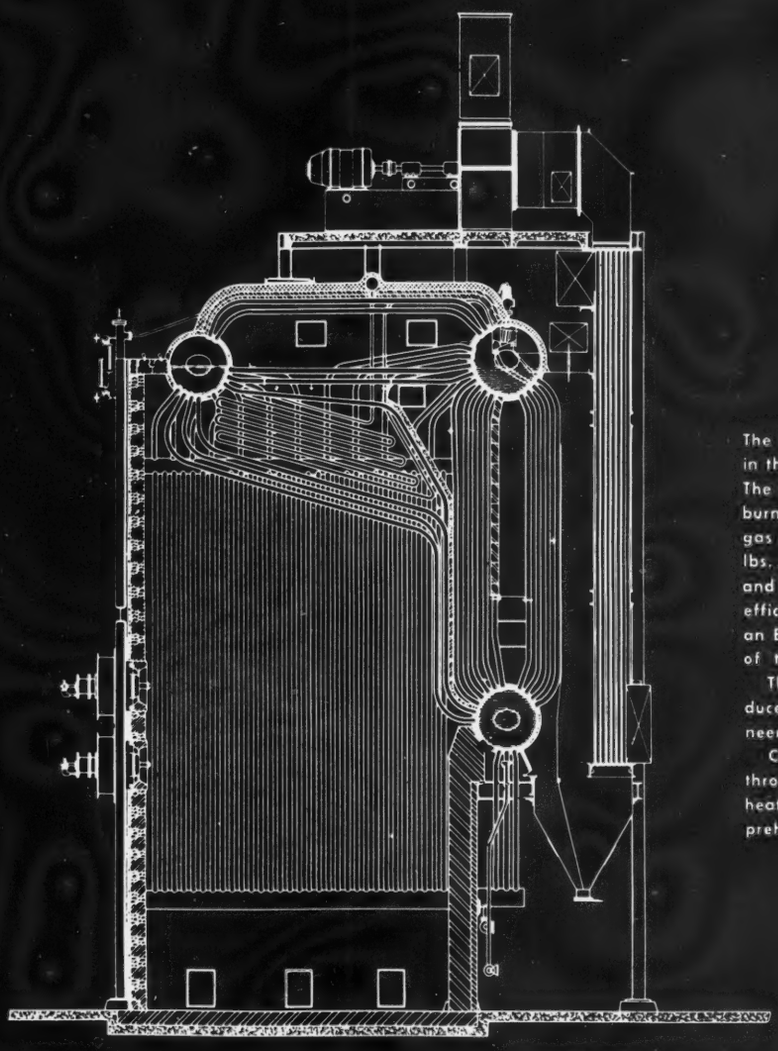
CHICAGO PNEUMATIC TOOL CO announces that its branch office in El Paso is now located at 515 Texas Street. to provide larger modern facilities for repair work and to speed shipment of parts. The former headquarters was located in the Mills Building.

The new location is a one-story building which has been remodeled to standard company specifications. and new equipment has been installed for the repair and maintenance of the full line of C-P equipment, which includes pneu-

DUPLICATION OF THIS EDGE MOOR RADIANT HEAT BOILER

— built for the City of Fairbury, Nebraska —

CAN BE MADE WITHOUT DELAY



The Edge Moor radiant heat boiler shown in the cut has been in operation since 1937. The unit is equipped with combination burners for operation on fuel oil, natural gas or pulverized fuel and produces 40,000 lbs. of steam per hour at 450 lbs. pressure and 725 F. final steam temperature. High efficiency is obtained by the installation of an Edge Moor tubular air heater at the rear of the boiler.

This steam generating unit can be reproduced with a minimum of delay as all engineering work has been completed.

Complete installation service is available through Edge Moor including boilers, superheaters, water walls, economizers and air preheaters.

EDGE MOOR IRON WORKS, INC. 30 ROCKEFELLER PLAZA NEW YORK, N. Y.

KANSAS CITY CHICAGO DETROIT RICHMOND, VA.

IN CANADA:— UNITED STEEL CORPORATION, LTD., TORONTO, MONTREAL

Type "D" Self-Draining Pressure Gauge

EXCEPTIONAL WEARING QUALITIES LONG LIFE, AND ACCURACY

distinguish this and all other Lonergan gauges. Lonergan safety appliances are designed carefully for maximum accuracy and service . . . each part GUARANTEED to be made from the best materials with unexcelled workmanship.

Lonergan

70th Anniversary

★ SINCE 1872.

MANUFACTURERS OF PRECISION

Valves-Gauges Specialties

J. E. LONERGAN CO.

RACE & SECOND STS., PHILA., PENNA.

REPAIR CONCRETE to a Tough Feather Edge

RUGGEDWEAR RESURFACER bonds solid and tight right up to irregular edge of old concrete. Won't crack and crumble at joint where ordinary patching materials first show signs of going to pieces. Used for repairing holes, cracks, ruts, broken places in concrete floors . . . or for a complete, durable overlay. No chopping or chipping required—mix the material—trowel it on. Sets up a smooth, heavy-duty rugged wearing surface . . . indoors or out. Dries fast.

Request valuable descriptive bulletin on "TOUGH FLOORS".

MAKE THIS TEST!

FLEXROCK COMPANY

2377 Manning St., Phila., Pa.

Please send me complete RUGGEDWEAR information . . . details of FREE TRIAL OFFER — no obligation.

Name .....

Company .....

Address .....

matic and electric tools, rock drills, air compressors, etc. The new office will be in charge of E R Goss, district manager, long a resident of El Paso.

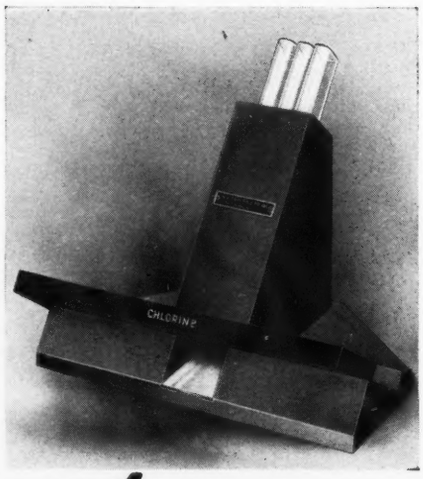
SEAMLEX CO INC announces new address for its enlarged plant and main offices at 27-27 Jackson Ave, Long Island City, N. Y.

BENWOOD LINZE CO, St Louis, Mo, designers, engineers and manufacturers of electrical rectifiers and rectifier-transformer assemblies announces a further step in their overall program of expansion, namely, purchase of Fore Electric Company, located at 4800 Delmar Blvd, St Louis. The purchase includes all of the company's equipment, inventory, assets and trade-name. All facilities have been moved to the plant of the Benwood Linze Company at 1815 Locust St. The Fore Electric Company was founded in 1917 under the direction of Albert Wehmeier, a well-known figure in the automotive and electrical industry for many years, who today is the retiring president of the firm.

To personally survey the extensive plant expansion now completed by the PACIFIC PUMP WORKS. Pacific executives, and executives of the affiliated eastern companies met in Los Angeles, June 22, 1942. In this group were J B O'Connor, vice-president of Clark Bros Co and chairman of the board of directors of the Pacific Pump Works; C P Clark, president of Clark Bros, and vice-president of Dresser Corporation; A R Weis, president of Pacific Pump Works; and Elmer Weis, vice-president of the Pacific organization. The Pacific Pump Works and Clark Bros Co are affiliates of the Dresser Corporation, as is the Bryant Heater Company of Cleveland.

Speaking of the expansion work already completed, Mr Clark, who is a director of Pacific, said "Although we have already doubled the acreage covered by our Los Angeles plant, trebled the square footage of plant building, and quadrupled the number of employees, we plan to go even further if the War Production Board indicates we can serve the United Nations better. Every affiliated plant is working on all-out basis in producing materials for our war effort. It can be truthfully said that each concern is now 100 percent on war production and intends to continue on this basis for the duration."

From J B O'Connor came a statement of interest having to do with sales and service efforts of the affiliated organization. Mr O'Connor said "Since all of our peace-time customers are now on War Production Work—where quick de-



Analyze BOILER WATER this Easy, Quick Way!

The new Taylor Water Analyzer is a sturdy outfit especially designed for speedy and accurate determination of the ammonia content and pH of condensate . . . the latter generally acknowledged as one of the most difficult pH determinations. The CO_2 and ammonia content must be known when total solids are determined by conductance measurements, since these dissolved gases may contribute as great a conducitivity as that representing the dissolved solids. Now, you may quickly and accurately determine both pH and ammonia content of condensate, as well as silica, total iron, etc., in boiler water, in a few minutes by using the Taylor Water Analyzer!

Complete with 1 slide...$18.00

Extra slides, each..... 8.00

F.O.B., Baltimore

All Taylor color standards carry AN UNLIMITED GUARANTEE AGAINST FADING!

Get This Booklet

See your dealer or write direct for booklet "Modern pH and Chlorine Control" — a factual, informative booklet that you will find extremely useful.

W. A. TAYLOR AND CO.

YORK & ROGERS FORGE RDS. • BALTO. MD.

Information about alloys...

GEARED

to industry's war needs

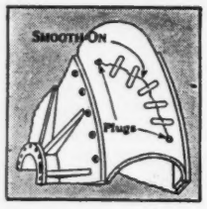
Converted to wartime tasks, American industry requires and calls upon us for information about alloys. Quickly available are practical answers to your questions about the selection, fabrication and uses of ferrous and non-ferrous materials containing Nickel. • Even before World War I, this Company pioneered studies of special alloys that provide added strength, toughness and wear-resistance. Our years of experience have been digested into printed reports and data sheets that help you save time and material. • Now, with all Nickel allocated where it may best speed Victory, our studies of alternative materials and processes become especially useful. • Upon request, personal assistance from our technical staff supplements the data in our printed bulletins.

NICKEL

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

SMOOTH-ON

used by thousands of engineers as insurance against production delays



For Speedy Repairs to...

Equipment
Pipe Lines
Fixtures

War efforts necessitate full-time operation. Lengthy production delays due to repairs of equipment and pipe lines are too costly in valuable time to be tolerated.

For insurance against such delays, be sure to keep a can of SMOOTH-ON No. 1 handy. With this many-purpose iron cement, you will be prepared to stop leaks in seams and joints, seal cracks in casings of pumps, valves, process apparatus, etc., and tighten loose parts of machinery and fixtures.

SMOOTH-ON repairs do not require dismantling of equipment, nor the use of heat or special tools, and the results are lasting. In addition, SMOOTH-ON repairs avoid the necessity of waiting for replacement of parts which are difficult to obtain, as well as being quicker than other repair methods.

FREE

The Smooth-On Handbook — 40 pages with 170 diagrams and concise, easily followed instructions for practical equipment repairs, based on the experiences of thousands of engineers. Send the coupon for your copy.

Buy Smooth-On in 1-lb., 5-lb. cans or 25-lb., 100-lb. kegs from your supply house or if necessary, from us. For your protection, insist on Smooth-On —used by engineers since 1895.

SMOOTH-ON MFG. CO., Dept. 30
570 Communipaw Ave., Jersey City, N. J.
Please send SMOOTH-ON HANDBOOK.

Name .....

Address .....

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8-42

Do it with
SMOOTH-ON

livery is of the utmost importance—every effort is being made to supply them with needed products and materials wherever possible. Sales engineers and service men from each company are working with customers helping them to handle problems of maintenance and increased production volume. Our affiliate organizations are operating on the basis that every coupling, engine or pump that can, through proper maintenance and service, be made to do for the duration, provides just that much more material, and more man hours for the production effort. Our many friends throughout the industry have been most understanding and cooperative in this connection."

TIMKEN ROLLER BEARING CO announces that, despite curtailment of peacetime manufacturing, its staff of field engineers is being kept virtually intact to engineer and service hundreds of new wartime applications. The few field engineers who have been called to the home office to help in the country's 'round-the-clock production effort will assist in this work for the duration, after which they will resume field engineering work in their respective divisions.

WATER TREATMENT COMPANY OF AMERICA, Pittsburgh, announces that its scientific method of water conditioning for boilers, condensers, etc. known as the Technical System, will be sold and serviced by American Radiator and Standard Sanitary Corp's branches located in Akron, Canton, Cleveland, Columbus, Erie, Lima, Mansfield, Springfield, and Toledo, Ohio; Fort Wayne, Indiana; and Wheeling, West Virginia. This distributorship arrangement will broaden considerably the sales and service facilities in a concentrated area.

YORK ICE MACHINERY CORP, of York, Pa, because of the increasing volume of war production contracting, has enlarged and increased the facilities of its Washington offices. To be designated as the National sales office, the establishment will operate as a direct factory branch office, located at 215 Investment Bldg. M S Lebair, formerly manager of York's factory branch in Philadelphia, is the new branch manager.

York also announces appointment of Alfred Christensen, formerly sales manager of the York Brooklyn branch, as manager of a new downtown office in Manhattan. Located in the Pershing Square Bldg at 100 E 42nd St, the new branch will provide a central location for sales and factory-branch fa-

NEED A NEW DOOR LINING *or* SPECIAL REFRACTORY SHAPES... *FAST?*

Cast them yourself... FAST. Use a Castable Refractory made with **LUMNITE!**

IF YOU'RE in a hurry to replace a door lining, arch, baffle, burner block, or some special refractory shape, you can do it quickly with a Castable Refractory.

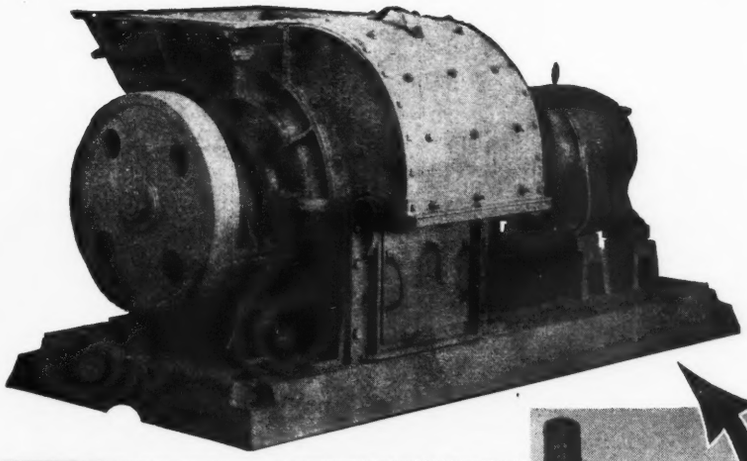
Pour the dry castable mixture out of the bag and mix it with water right on the job. The resulting Castable Refractory, poured in a form to make jointless one-piece walls or arches, or placed in a home-made mold to get a precast shape, is ready for service 24 hours after mixing. No waiting... no delay... no production time out.

A Castable Refractory handles as easily as ordinary concrete. There's no cutting or fitting... no ramming... practically no shrinkage in drying or firing. It's not affected by steam or moisture. Has high resistance to spalling. Can be stored indefinitely.

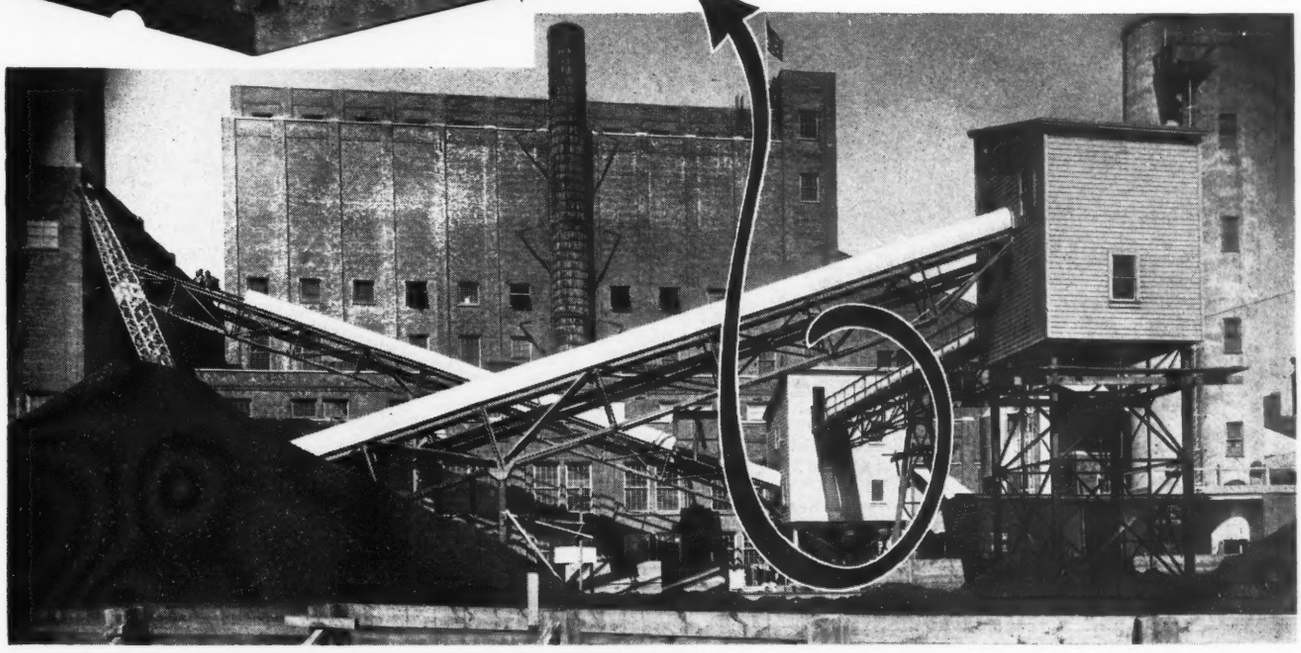
Specify Castable Refractories made with LUMNITE, and you get a balanced, always uniform product, made with carefully selected aggregates and the hydraulic binder which made Castable Refractories possible. Castables to meet different temperature and insulation needs are made by refractory manufacturers and sold by their distributors.

The Atlas Lumnite Cement Company
(United States Steel Corporation Subsidiary)
Chrysler Bldg., New York City

Specify
CASTABLE REFRACTORIES MADE WITH LUMNITE



The "AMERICAN" WAY is the ECONOMICAL WAY to SIZE COAL...



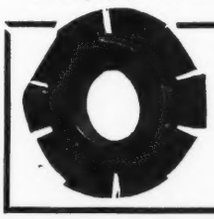
That's the verdict of the Maine Seaboard Paper Company

The "American" Ring Crusher at this big paper plant in Bucksport, Maine, is housed in the small building in the center of the picture. The installation is so compact that the photographer couldn't get a good shot of the equipment itself.

In this "way down East" plant, as in others in all parts of the country, the "American" way of preparing coal contributes to greater production, more steam and lower steam costs. Proper crushing can always be depended on to specific requirements because the "American" provides a simple, easily made adjustment to obtain exactly the size crushed coal required to meet the firing conditions involved.

Here, too, as in the other plants where "AMERICANS" are installed, crushing costs average less than one cent per ton for both operating and fixed charges.

It will pay you to investigate the many features offered in "AMERICAN" Ring Crushers.



THE "AMERICAN" WAY SPLITS THE COAL

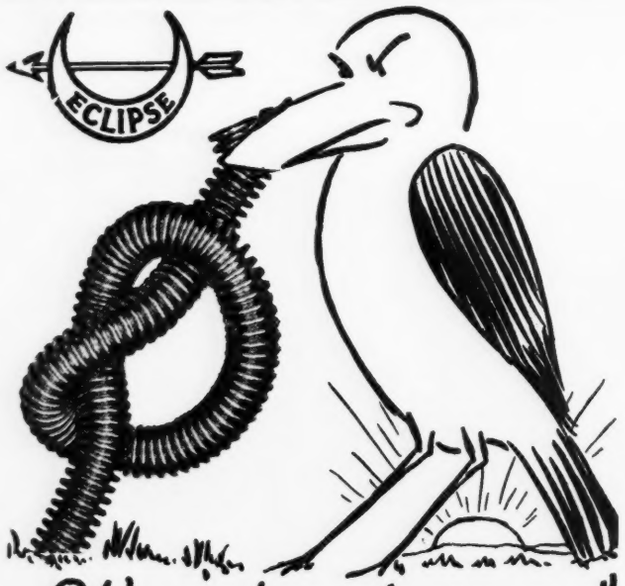
Instead of crushing coal with the possibility that clogging might result, the "AMERICAN" sizes the coal exactly by splitting it. This is accomplished by means of manganese steel shredder rings, an exclusive "AMERICAN" feature.

SEND TODAY FOR INTERESTING BULLETIN —FREE ON REQUEST.

AMERICAN PULVERIZER COMPANY

ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS

1349 MACKLIND AVE., ST. LOUIS, MISSOURI

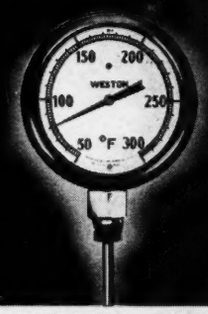


"It's a tough worm" says this bird.

For conveying non-solids and non-abrasives under conditions requiring maximum flexing and expansion. CHEMICALS, REFRIGERANTS, OILS, GASES, AIR, STEAM, VACUUM, HYDRAULIC, etc. Withstands high temperatures and pressures. Write for complete details.

ECLIPSE AVIATION
SEAMLESS FLEXIBLE METAL HOSE
Manufactured and Sold by
BENDIX AVIATION CORP.
4704 Wissahickon Ave. **Philadelphia, U.S.A.**

YOU CAN STAND BACK FOR A *Close-Up* READING!



...all-metal temperature gauges also provide the ruggedness ...the long-life accuracy...essential in these busy days!

Every step . . . every minute . . . is vital in this battle against time. Which explains why WESTON all-metal Temperature Gauges have been so widely adopted throughout industry. Readily mounted at any angle desired, their large gauge-type dials can be accurately read from a distance. In addition, their simplified all-metal construction . . . without liquids or gases . . . provides unusual ruggedness and eliminates the common sources of thermometer troubles. They stay "on the job" . . . maintaining their high initial accuracies . . . *far longer!* Available in sizes and stem lengths for most needs. Accuracy guaranteed within 1% over entire scale. Literature sent on request. Weston Electrical Instrument Corporation, 679 Frelinghuysen Avenue, Newark, New Jersey.

WESTON ***ALL-METAL*** **TEMPERATURE GUAGES**

cilities in New York and the metropolitan area. This office will replace facilities formerly located in Brooklyn, which property has been sold to the U S Coast Guard.

NAVY E Awards

The following companies, according to information received this month, have been presented with the Navy "E" award, for excellence of performance in the fulfillment of naval ordnance contracts.

WORTHINGTON PUMP AND MACHINERY CORP — Award presented to Harrison plant June 26.

WEST BEND ALUMINUM CO—Award presented May 23.

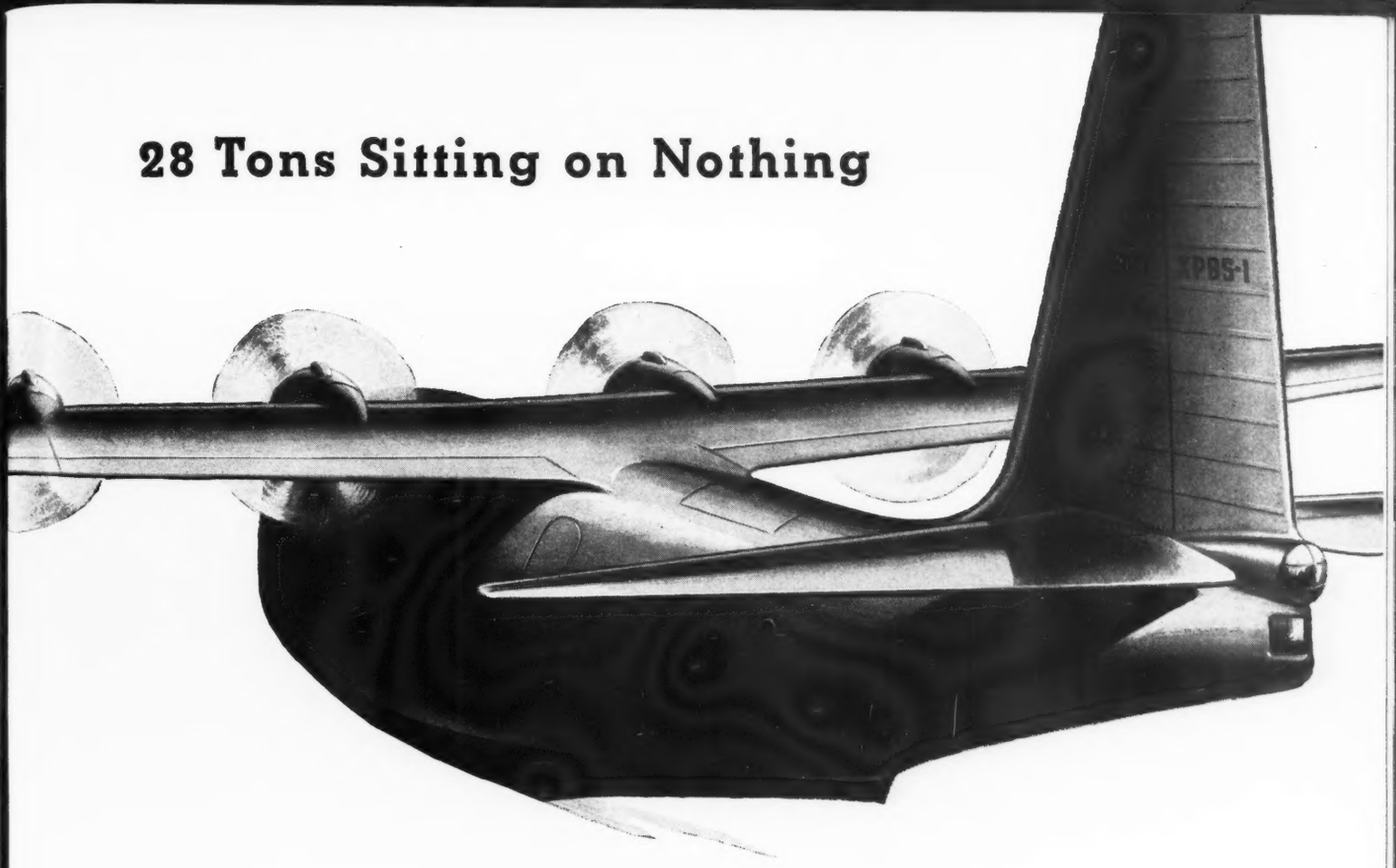
GENERAL ELECTRIC CO—Award presented to Schenectady works June 20.

JOHN C DOLPH CO announces appointment of J G Glenn Co of 605 West Washington Blvd, Chicago, as exclusive representative for Dolph insulating varnishes and compounds in the Chicago territory. A stock of standard grades will be carried at the above address for the convenience of local customers.

J F PRITCHARD & Co, Kansas City, recently has enlarged its division of chemical design, engineering and construction to meet growing requirements of the new petro-chemical industry. Dr W W Deschner, formerly in charge of the department of chemical engineering at the University of Kansas, is the new active head of this division. Emphasis placed on petro-chemistry is directly due to rapid developments in this field, according to Pritchard officials. This organization has long been active in the petroleum, power and natural-gas fields in connection with design and installation of compressor stations, dehydration plants, cycling and extraction plants, steam, diesel and gas power plants, cooling towers and similar equipment.

SQUARE D CO has opened a branch office in Springfield, Mass, to keep step with the tremendously increased machine-tool activity in the central New England area. C T Nash, formerly ma-

28 Tons Sitting on Nothing



TO PULL THIS 28-TON LEVIATHAN into the air—to keep it flying—requires engines of super horsepower—engines that didn't exist, except on a drawing board, not so many months ago.

How the power of 1500 horses can be compressed into an engine hardly wider than your outstretched arm—how this terrific force can be delivered to turn a propeller at the end of a shaft is all a part of America's industrial genius.

A secret of the modern airplane engine's might is gears—gears so light in weight, ground to such close tolerances that engineers almost despaired of ever producing them except under laboratory conditions.

But the urgency of war demanded that these gears be mass produced at no sacrifice in lightness or precision. Today in the plant of Foote Bros. Gear and Machine Corporation these "jewels of power transmission" are flowing out to help power American planes.

All this meant new manufacturing techniques—new production methods. American manufacturers may look forward with confidence to the application of these developments to peacetime speed reducers and gears to assure better machines—quieter machines—produced at lower cost.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 S. Western Boulevard • Chicago, Illinois

FOOTE BROS.

SPEED REDUCERS ★ GEARS ★ SPECIAL ASSEMBLIES

DEFINITE SAVINGS

in time, materials and money have resulted for countless plants where furnace linings are laid up with

ADAMANT
FIRE BRICK CEMENT

In most fire brick constructions the joints are the weakest points, where breakdowns generally get their start. But Adamant's great bonding strength makes the joints as strong as the brick they bond so that furnaces can be kept in operation longer before rebuilding becomes necessary.

PROOF

of the high bonding strength of Adamant is indicated by impartial laboratory tests that showed an average modulus of 800 lbs. per sq. in. at room temperature, 1270 lbs. per sq. in. at 2600° F.

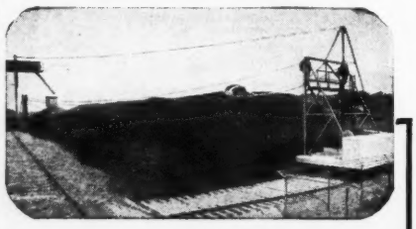
ADAMANT has a P.C.E. of more than 3000° F.

Further information sent on request.

BOTFIELD
REFRACTORIES COMPANY

784 S. Swanson St., Philadelphia, Pa.
In Canada, Canadian Botfield Refractories Co., Ltd., 171 Eastern Avenue, Toronto

SAUERMAN
Power Scrapers



STORING COAL
—at lowest cost

At hundreds of power plants today Sauerman Power Drag Scrapers are storing and reclaiming coal at costs of a few cents per ton handled. This low cost is due to the rugged simplicity of the Sauerman equipment and its easy automatic operation.

Aside from its economy, the most important fact about this system is that it piles the coal in layers and avoids size segregation. There is little chance of spontaneous combustion when coal is piled in this manner.

Write for Catalog.

SAUERMAN BROS., Inc.
562 S. Clinton St. Chicago, Ill.

HI-TEST KEWANEE

POWER, INDUSTRY OR PROCESS STEAM

Cut-away view showing refractory lined firebox

A quick steaming, *All-Welded* portable boiler, economical to handle.

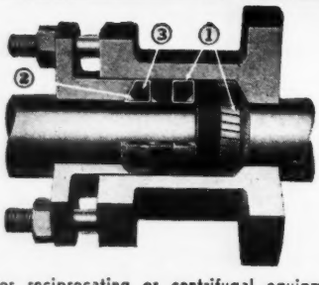
Refractory lined firebox and two-pass tubes are easy on the fuel bill. 6 sizes, 50 to 150 H.P.

125 and 150-lb. steam working pressure.

For 6″ rule with scale for reading pipe sizes, write Dept. 89 K-VIII.

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS

There are 3 INDIVIDUAL SEALING ELEMENTS



in SEA-RO ARMORED NEK-SEAL PACKING No. 1505

1. **ARMORED CASING** of anti-friction foil provides full metallic surface that will not score.
2. **NEK-SEAL FILLET** of foil at pressure corner of packing —provides extra sealing and prevents crowding out of stuffing box.
3. **SEMI-METALLIC CORE**—anti-frictional and resilient—assures proper-contact with rod or shaft.

Sea-Ro Armored Nek-Seal Packing No. 1505 is recommended for reciprocating or centrifugal equipment, operating against extreme pressures and speeds. Write for details.

SEA-RO PACKING CO., INC., WOOD-RIDGE, N. J. SEA-RO

chine-tool specialist in Square D's New York office, where he has been contacting New York and Connecticut machine-tool manufacturers for the past 12 years, will be in charge of the new office. Through this new branch, located at 146 Chestnut St, Square D is serving the Hartford area, Springfield, Vermont, Worcester and Providence.

D W Haering Organization announces addition of several thousand sq ft of floor space to its general offices on the 18th floor of the Engineering Bldg in Chicago. Recent personnel additions include the appointment of A J Grotsma, controller, and Robert Styl, director of service. Ilya Stephanoff, Mitchell S Sniegowski and Isabelle Luan, chemists, have been added to the laboratory staff. Jack Daggett, chemist, has been transferred from the laboratory to the field engineering department and John J Meacher, field engineer in Cincinnati, has been appointed District manager of the new Cincinnati District Office. D W Harrington has been placed in charge of the Philadelphia office at 1200 Commercial Trust Bldg, with A J Levington and John C McKeon operating under his direction. John Banks has been placed in charge of the Pittsburgh office at 207 Investment Bldg.

Other appointments include: Dr Leonard Elion, N. Y. field staff; William Wagner, Boston field staff; Brad Fogarty, central Pa field staff; Guy Hudson, Arkansas River Valley and Texas Panhandle areas; John P Warble, Chicago field staff; Lewis C Hills, Indianapolis territory; J C Dickinson, Jacksonville field staff; and John D Noyes, Miami.

Correction

On page 111, July, Power, in the article "How to Buy a Secondhand Boiler," the second sentence in the first paragraph should read, ". . . and if it is a stayed area. . . ." The word "not" should be omitted.

Rating P-46 Revised

The War Production Board issued today a complete revision of Preference Rating Order P-46 which was issued last September to assist utilities in obtaining the minimum amount of materials necessary for maintenance, repair and operation. That order assigned a blanket preference rating of A-10 to such materials.

Today's order supersedes the original order and all amendments thereto and

SAVES 61 REPACKING JOBS $199.17 on ONE PUMP with DARCOVA PUMCUPS

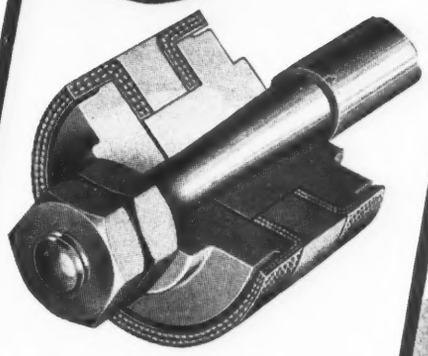
"We were repacking a Simplex steam pump on one of our critical service gasoline lines every 4 days," reports a large and well-known refinery. "Based on the millions of barrels pumped annually, this was running into a costly operation figure and something had to be done about it."

"Then, we installed Darcova Pumcups and kept track of the costs. Today, those same Pumcups are still operating in the pumps and going strong, having already shown a 245-day savings of $199.17. What's more, from the time of installation the Darcova Pumcups materially reduced slippage and increased pumping capacity by 1800 gallons per hour."

You, too, can make important savings! Don't wait—start now to cut your reciprocating pump costs by installing Darcova Pumcups. Your pumps, new or old, regardless of present packing will operate with more efficiency, once this money-saving Darcova installation is made.

Take Advantage of the FREE DARCOVA SURVEY SERVICE

Darcova engineers can help you get the most from your pumping dollar. Phone, wire, or write—or ask any supply store. Darcova offers a complete line of Pumcups, Pistons, Valve Cups, Balls and Seats, Seating Cups, Seating Rings for oil well and reciprocating pumps.



A Simple Operation Removes Your Present Pistons and Equips Your Pump With This Inexpensive Adapter

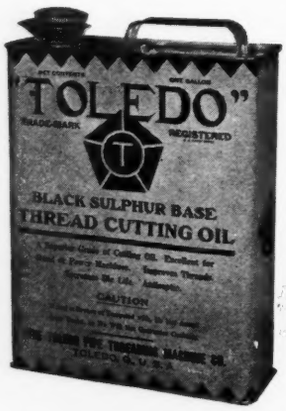
Here is a close-up photograph showing the assembly of Darcova Pumcups and a Darcova Pumcup Piston. The piston is inexpensive and easy to install on any type of piston rod in your reciprocating pumps, regardless of make or model. The metal parts of Darcova Pumcup Pistons are machined to close tolerances to assure accurate fit of cylinder bore and Pumcups.

DARCOVA TRADE MARK

THE ORIGINAL COMPOSITION CUP

DARLING VALVE & MANUFACTURING CO.

WILLIAMSPORT, PA.

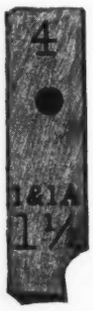


IT DOES MAKE A DIFFERENCE

Steel is scarce and it's important that every one conserve it. One sure way to increase die life is by using "TOLEDO" cutting oil. You will be amazed at the results—

easier cutting
cleaner threads
longer die life

When your dies do become dull—don't throw them away. We will be glad to regrind them for a nominal charge.



KEEP THEM SHARP

Save steel for victory.
Save money by regrinding your old dies.

"TOLEDO"

TOLEDO PIPE THREADING MACH. CO.

TOLEDO, OHIO NEW YORK, N. Y.

BETTER SERVICE — SAFETY — SATISFACTION
FOR REPLACEMENTS ORDER

PRECISION GAGE GLASSES and GAGE GLASS GASKETS THAT WILL NOT BLOW OUT

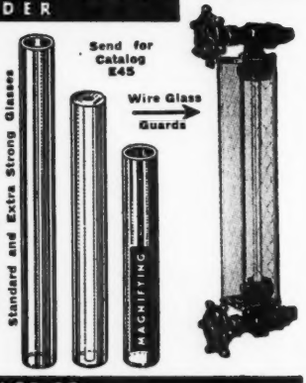
Standard Square Cut Gaskets High Pressure Non-hardening and Non-softening

GASKETS THAT WILL FIT EXACTLY

Red Lip-mold Pattern Expansion Type Gasket

Send for Glass and Gasket Chart

Shipment made by parcel post the same day as order is received



ERNST WATER COLUMN & GAGE CO.
RUBBER & GLASS DIVISION LIVINGSTON, NEW JERSEY

makes several important changes, the principal of which are:

1. The blanket rating of A-10 in the original order is replaced by two higher ratings. An A-2 rating is granted to deliveries of material for maintenance, repair and operating supplies for power plants and pumping plants. An A-5 rating is granted for all facilities, such as lines, pipes and substations. One of the reasons for the distinction is that if a power plant or a pumping station breaks down, the whole system is put out of business. If a power line or a water pipe breaks, only a part of the system is affected. In either case the rating is high enough to make possible prompt reply.

2. The order also assigns a rating of A-5 to deliveries of materials to bring electricity, gas or water to war plants or other projects bearing a rating of A-5 or better. This does not apply to housing projects. An A-5 rating is also granted to deliveries of materials needed to protect power or water plants against sabotage such as fencing, tear gas bombs for guards around such plants, etc. These ratings may not be applied without prior authorization from the Director of Industry Operations of the War Production Board.

In the Service

From information received during the past month, Power here presents a brief summary of power men who have left their business positions to enter the armed services.

HAROLD F MARSHALL, sales and advertising executive for Warren Webster & Co, Camden, manufacturers of steam-heating equipment, has been ordered to active duty with the U. S. Army Air Forces, with the rank of captain.

Ben F Lerch will carry on Captain Marshall's work for the duration.

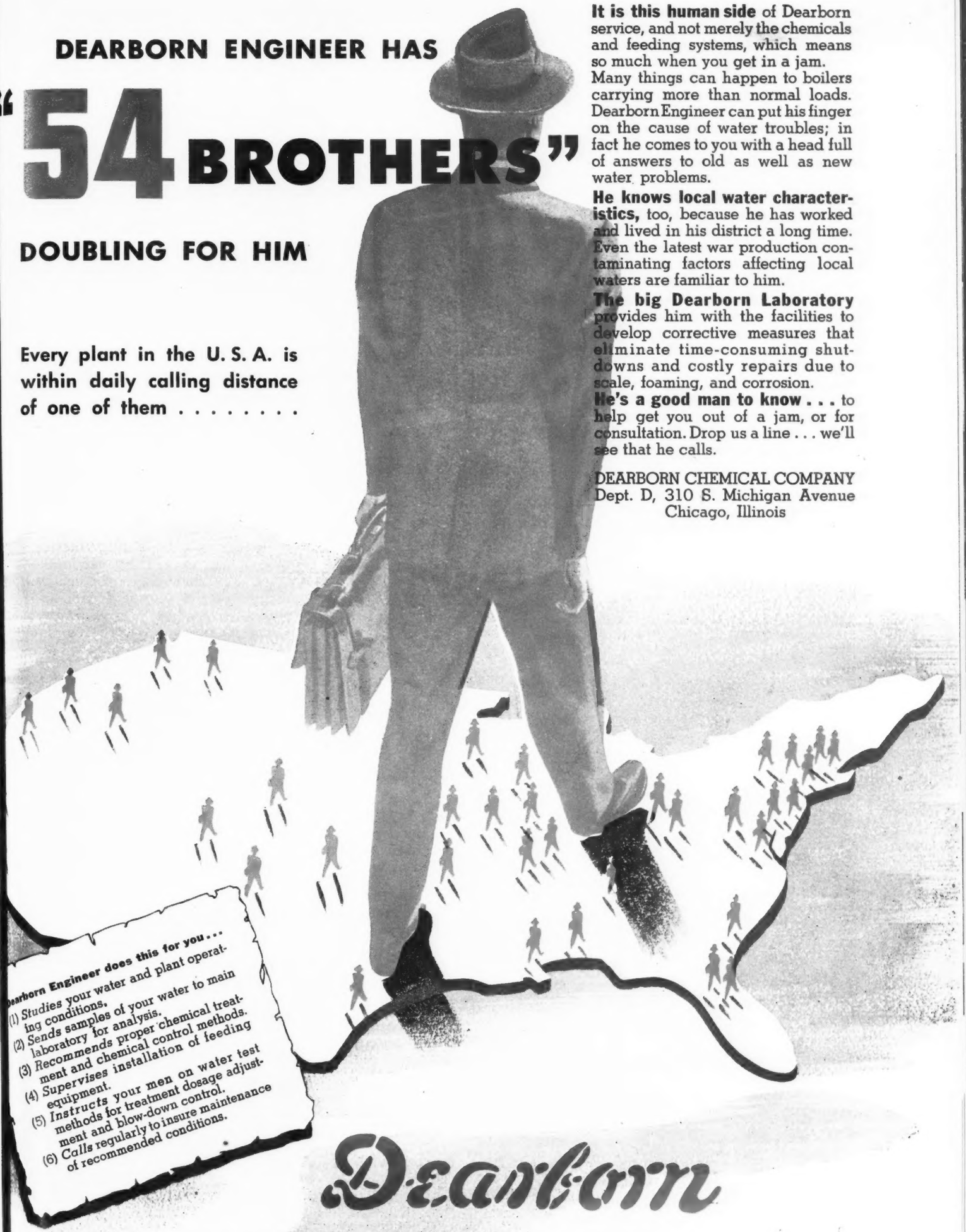
MAURICE B BRADLEY, since 1924 in charge of the Cleveland branch office of the Robins Conveying Belt Co, is now in active service as a major in the Coast Artillery Corps. Major Bradley was well known to industrial executives in the middle west, having been responsible for installation of important materials-handling machinery.

DEARBORN ENGINEER HAS

"54 BROTHERS"

DOUBLING FOR HIM

Every plant in the U. S. A. is within daily calling distance of one of them . . . . . .



It is this human side of Dearborn service, and not merely the chemicals and feeding systems, which means so much when you get in a jam. Many things can happen to boilers carrying more than normal loads. Dearborn Engineer can put his finger on the cause of water troubles; in fact he comes to you with a head full of answers to old as well as new water problems.

He knows local water characteristics, too, because he has worked and lived in his district a long time. Even the latest war production contaminating factors affecting local waters are familiar to him.

The big Dearborn Laboratory provides him with the facilities to develop corrective measures that eliminate time-consuming shutdowns and costly repairs due to scale, foaming, and corrosion.

He's a good man to know . . . to help get you out of a jam, or for consultation. Drop us a line . . . we'll see that he calls.

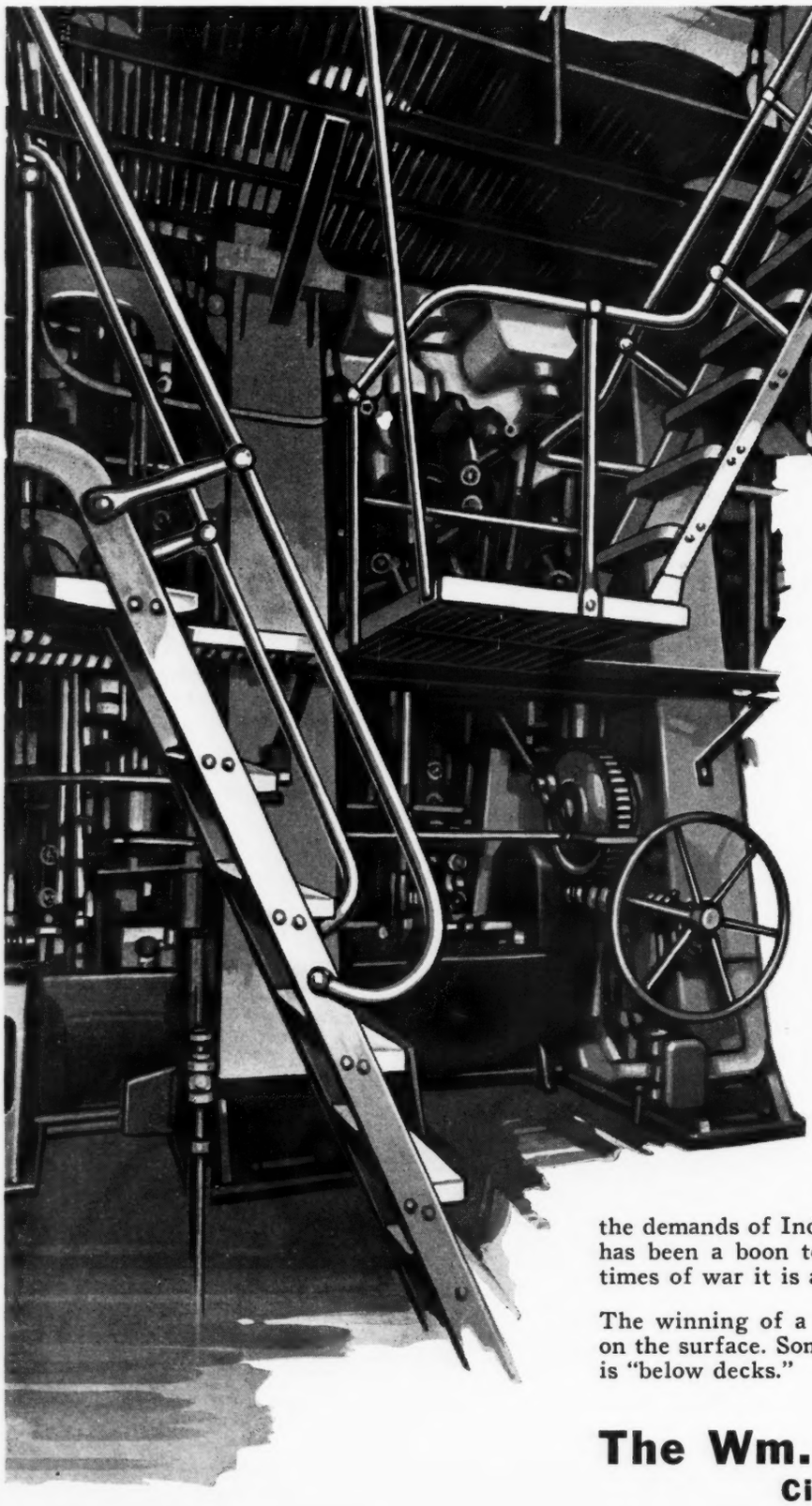
DEARBORN CHEMICAL COMPANY
Dept. D, 310 S. Michigan Avenue
Chicago, Illinois

Dearborn Engineer does this for you . . .

(1) *Studies* your water and plant operating conditions.
(2) *Sends* samples of your water to main laboratory for analysis.
(3) *Recommends* proper chemical treatment and chemical control methods.
(4) *Supervises* installation of feeding equipment.
(5) *Instructs* your men on water test methods for treatment dosage adjustment and blow-down control.
(6) *Calls* regularly to insure maintenance of recommended conditions.

Dearborn

WATER TREATMENT AND ENGINEERING SERVICE



THERE are not many valves in the Gun Stations and Fighting Tops of America's Warships. But below decks where the engines stay, there are valves by the hundreds. That they perform their functions dependably and well is as essential as is the performance of many another piece of equipment more easily seen, more often mentioned.

So it is in power plants, refineries, powder plants, chemical industries. Each depends on the precise control of the flow of liquids and gases for proper performance. Each depends on valves for this control.

It is small wonder that in time of war, when every ship must sail, when every factory must produce to the limit, that Powell Valves are in such great demand. For Powell Valves are backed by a century of experience, and a proud record of performance. Powell Engineers are trained to anticipate the demands of Industry. In times of peace this service has been a boon to American Industrial Progress. In times of war it is an essential military requirement.

The winning of a war takes a lot that does not show on the surface. Some of this, particularly valve control, is "below decks."

The Wm. Powell Company
Cincinnati, Ohio

POWELL

BELOW DECKS

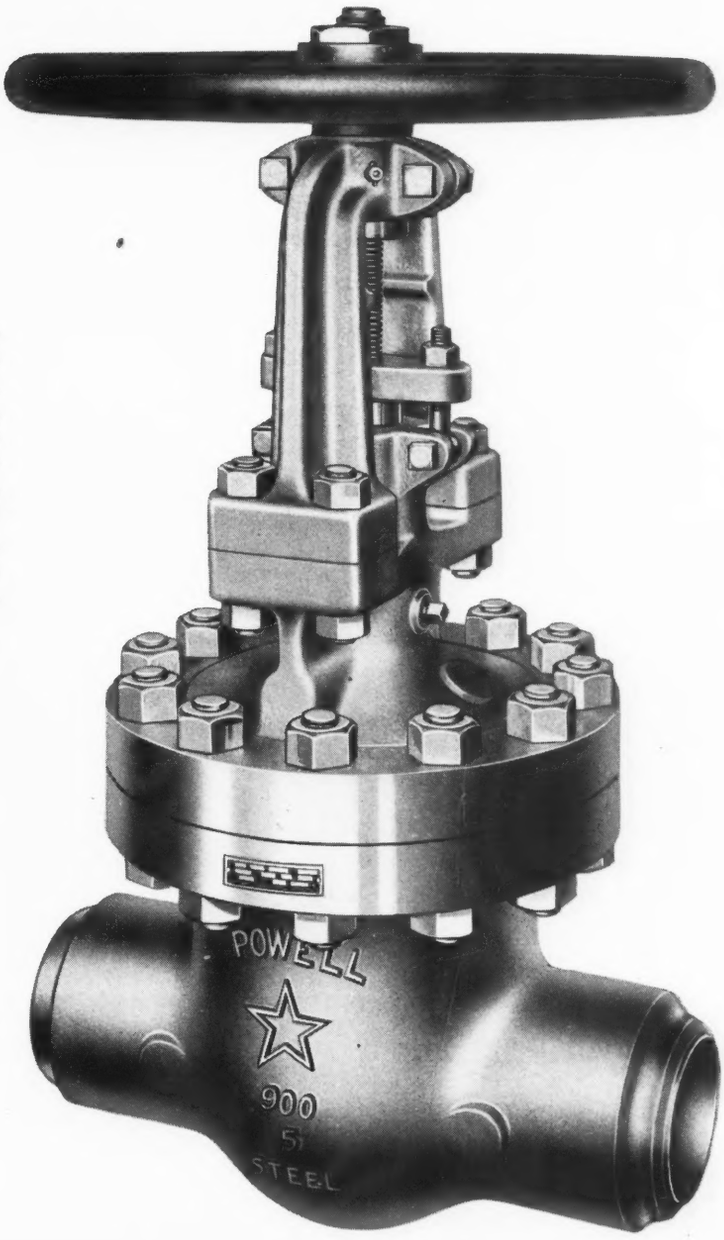


Figure 9003 W. E.

Class 900 pound Cast Steel Gate Valve with Welding Ends, Outside Screw Rising Stem, and Bolted Flanged Yoke. Seat and disc are hard faced with Stellite. Available in sizes from 3" to 24". Sizes 6" and larger are regularly furnished with anti-friction bearings in yoke. It is one of a complete line of quality, long-life valves specially designed and built by Powell to provide the Nation's power plants with dependable flow control equipment.

VALVES

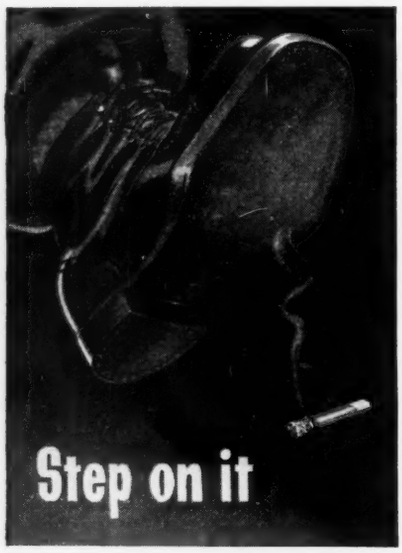
FIGHTING FIRES before they start

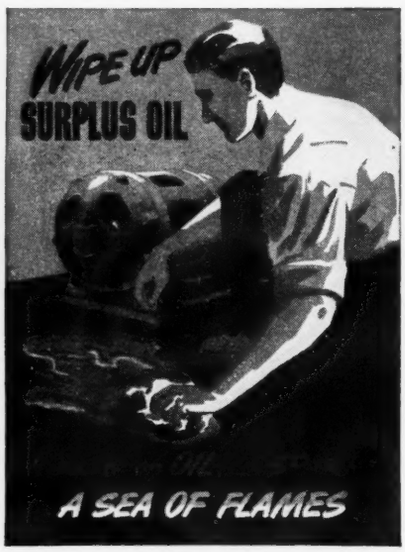
Most fires are preventable. A smoldering cigarette, flipped carelessly into a dark corner . . . a welder's spark flying unnoticed into a pile of oily waste—these little things can, and do, start devastating fires.

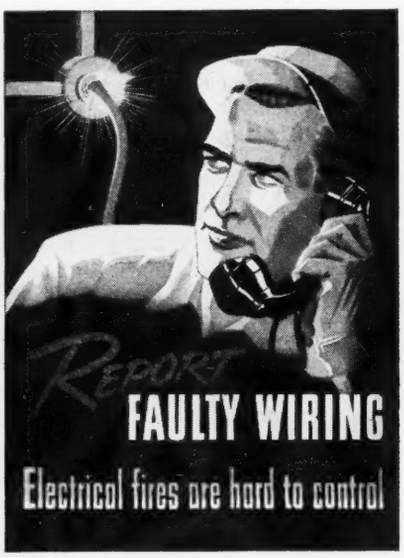
At the beginning of the war emergency, recognizing that fire is a treacherous and deadly saboteur of production, Bethlehem intensified its attack on the fire hazard. As always, trained, fully-equipped fire-fighting forces supplied the backbone of the fire-control effort, maintaining day-and-night vigilance in every Bethlehem plant and shipyard.

But to bring home the vital importance of fire prevention and control to every Bethlehem employee, we've designed a series of posters in full color and are displaying them in key locations throughout all Bethlehem shipyards and steel plants, which are now engaged in vital war work.

These posters are based on analysis of the most serious causes of fire and the all-important part of the human element in fire prevention. By pointing out to employees specific ways in which they can prevent or subdue fires, the posters are helping to minimize a potentially grave threat to the production of war materials.





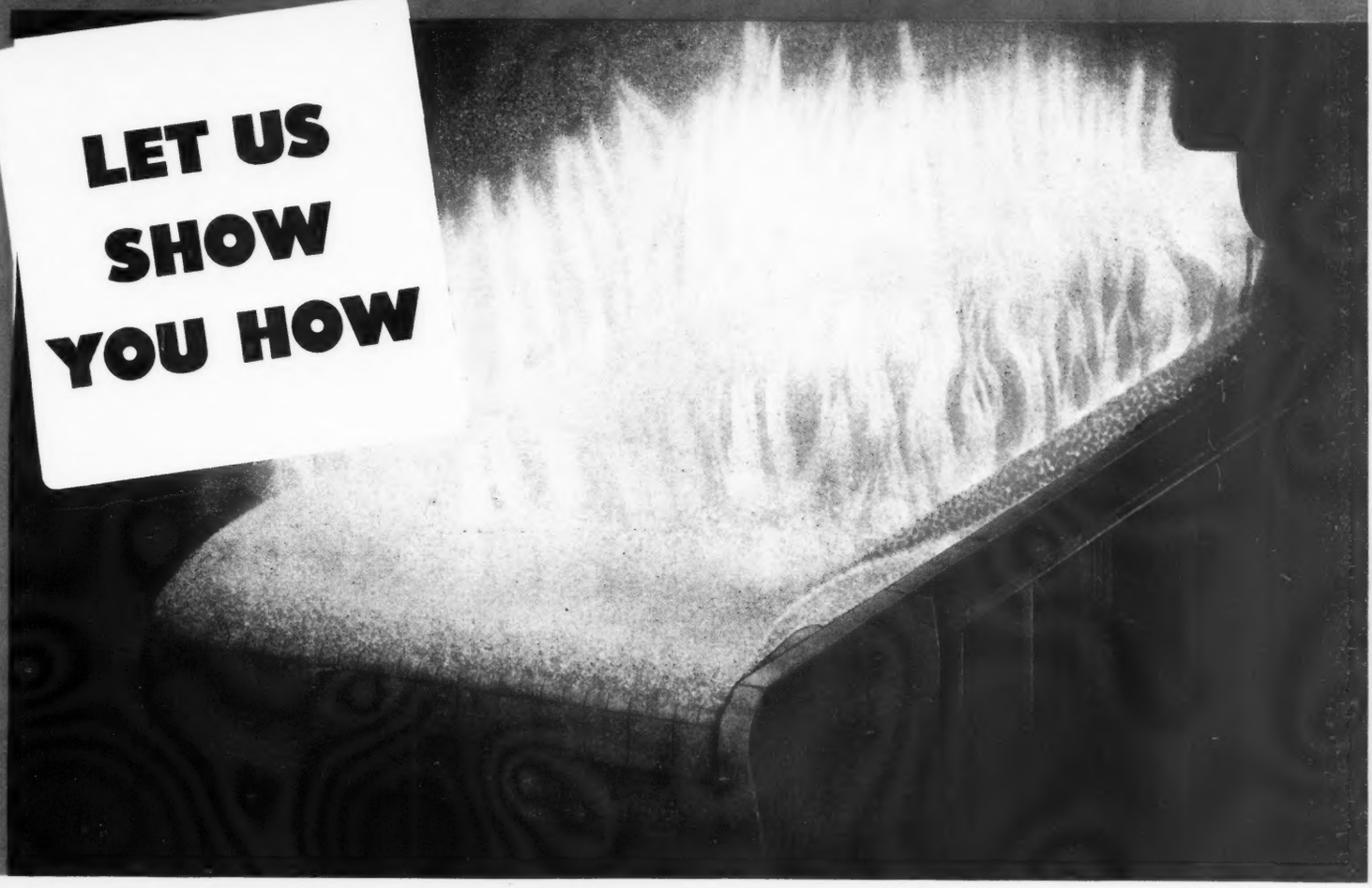


Five of Bethlehem's series of fire-prevention posters. These posters are printed in full color. Each poster is designed to emphasize a specific problem in fire prevention or control.

BETHLEHEM STEEL

War-production plant executives who are carrying on fire-prevention campaigns may find these posters of interest. A complimentary set will be supplied on request to Bethlehem Steel Company, Bethlehem, Pa.

YOU *CAN* GET MORE POWER QUICKLY..



● If you need more steam now—and can't wait for new boiler deliveries—it will pay you to investigate restokering your existing boilers with Stowe Stokers.

Due to their unique grate construction Stowe Stokers maintain a practically even fuel bed, side to side and front to rear at all times—resulting in ideal burning conditions—minimized draft problems—and exceedingly high heat releases per square foot of grate area.

Records on job after job in the utility, metal working, tobacco, rubber, and other industries, show that boiler outputs have been increased from 33% to 100%, simply by restokering existing boilers with Stowe Stokers.

Recommendations based on your specific conditions and equipment furnished gladly—write—

THE JOHNSTON & JENNINGS CO.

DETROIT 878 Addison Road CHICAGO
CLEVELAND, OHIO

Engineering and Sales Representatives in
New York · Pittsburgh · Kansas City · St. Louis

STOWE STOKERS

GIVE YOU MORE STEAM FROM LESS COAL

CAST IRON FLANGES

CAN BE SUCCESSFULLY SUBSTITUTED IN MANY PLACES

The war demands for forged steel flanges are greater than the ability of the shops to supply them. And the steel required is badly needed for other war production. The result is a rapidly developing "bottleneck" in much essential piping.

Cast iron flanges, on the other hand, are usually available on suitable priorities. Cast iron screwed and lap-joint flanges can be substituted with complete satisfaction in many places where operating conditions do not exceed 250 p.s.i. pressures and saturated steam temperatures.

As a part of its war effort, the Pipe Fabrication Institute has made a study to determine where such steel-saving substitutions will be advantageous. Member fabricators are ready to make recommendations on cast iron flange substitutions which will not impair piping quality.

Qualified pipe fabricators can help you get your piping more quickly . . . and at the same time give maximum cooperation to the war effort.

THE PIPE FABRICATION INSTITUTE

P.F.I. THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING • PITTSBURGH, PA.

E-4

HOW TO AVOID A

Fuel Problem

IN YOUR BOILER ROOM

In the race against TIME—when production goals demand that boilers operate at peak efficiency 24 hours a day, 7 days a week—the immediate scarcity and possible elimination of oil as a fuel is a threat that cannot be ignored. Now as never before it is well to look the facts in the face and PLAN the immediate future of your boiler room.

Many power plant operators have converted their oil-fired boilers into coal-fired boilers economically and quickly by installing an "F&E" manufactured "Huber" Hand-Fired Stoker. It is the ideal changeover equipment —low in cost, simple and inexpensive to install, obtainable in a comparatively short time. Efficiencies and capacities far in excess of those reached with ordinary hand-fired equipment are possible.

The "Huber" Hand-Fired Stoker has served thousands of plants successfully for more than twenty-five years. NOW—it is the practical answer to the present fuel problem.

Ask the "F&E" representative in your territory to show you the details of this equipment — show you the economies and advantages of changing over to coal NOW—with the "Huber" Hand-Fired Stoker.

FLYNN & EMRICH CO.

ESTABLISHED 1842 F&E BALTIMORE, MD.

Manufacturers of
'F&E' UNDERFEED STOKERS—'HUBER' OVERFEED STOKERS—'HUBER' HAND-FIRED STOKERS—'HUBER' SECTIONAL BOILER FRONTS

GREATER CAPACITY • LESS LABOR
GREATER ECONOMY • LESS SMOKE

Operates on Natural Draft — power cost is eliminated. Fires can be cleaned without loss of steam pressure. Can be installed in 24 hours —without alteration in present boiler setting or supports.

SPECIFY THE RIGHT SIZE CONTROL VALVE!

FISHER
CONTROLLERS
AIR or GAS CAPACITY CHART
DOUBLE PORT STANDARD BODY.
QUICK OPENING OR LOW LIFT V-PORT INNER VALVE
Quick Opening Inner Valve Travel Coefficients

USE FISHER ALIGNMENT CAPACITY CHARTS

1 TO OBTAIN BEST CONTROL

The *RIGHT SIZE* Automatic Controller assures better performance and longer trouble-free operation than the valve that is incorrectly sized. There is always a correct size for every set of operating conditions.

2 TO EFFECT GREATER ECONOMY

The *RIGHT SIZE* Automatic Controller effects substantial savings in initial cost and in maintenance expense. Charts avoid "over-sizing" of control valves — a costly procedure in both performance and investment.

3 TO CONSERVE VITAL METALS

The *RIGHT SIZE* Automatic Controller requires the minimum amount of vital metal. Correctly sizing control valves is a definite aid to the nation's metal conservation program.

FISHER Alignment Capacity Charts — developed from actual test data — provide a simple, accurate and dependable method of sizing FISHER automatic controllers to meet specific operating conditions. Bulletin AL contains charts for all fluids, covering both single and double port valves and various types of inner valves. Also includes complete instructions for using each chart. Write for your copy today.

FISHER GOVERNOR COMPANY, 420 FISHER BLDG. MARSHALLTOWN, IOWA

REEVES *Motodrive*

is Motor + Variable Speed + Gear Reducer

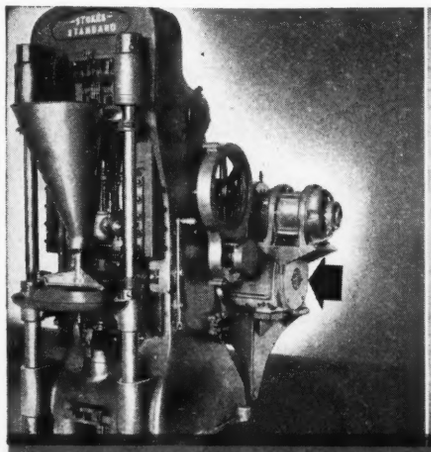
—*All in* 1 *Compact Unit!*

Install This Space-Saving Drive on Your Production Machines and Give Them "Fighting Speeds" for Faster Output

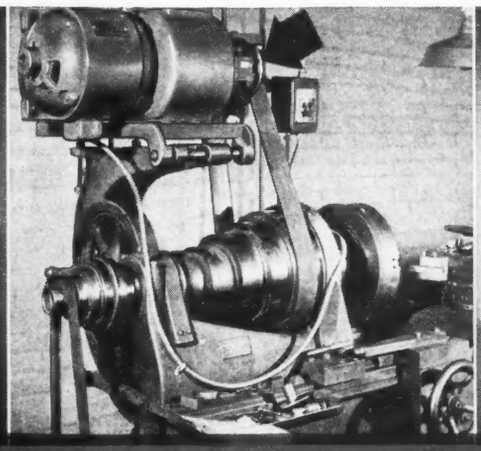
● On production machines where space is limited, or where direct connection to machine is necessary or desirable, the REEVES Motodrive solves the problem of providing infinitely variable and accurate speed regulation. This compact assembly of constant speed motor, variable speed mechanism and gear reducer (if needed) utilizes proved REEVES principle of a V-belt driving between two pairs of cone-faced discs adjustable to form an infinite number of driving and driven diameters. Any desired speed between predetermined limits is available at turn of REEVES Speed Control handwheel—*without stopping* driven machine.

The Motodrive is not restricted to any one make of motor. The unit is available, with or without speed reducer, in two designs, vertical and horizontal. Sizes from 1/4 to 10 h.p. and speed ratios from 2:1 through 6:1. Many different assemblies as to motor, output shaft, handwheel and speed reducer make the Motodrive adaptable for application to any driven machine. Gives any machine "fighting speeds" for more output. For further information on the Motodrive and two other basic REEVES units—Transmission and Vari-Speed Motor Pulley—send for 124-page Catalog Manual AG-419.

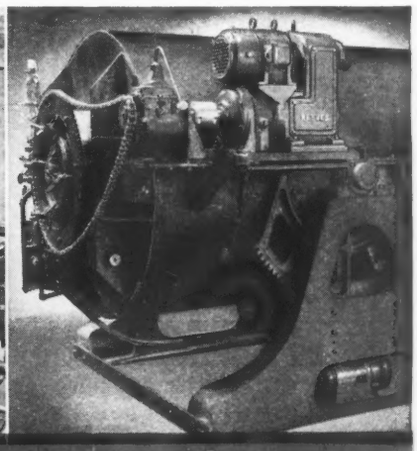
REEVES PULLEY COMPANY • COLUMBUS, INDIANA



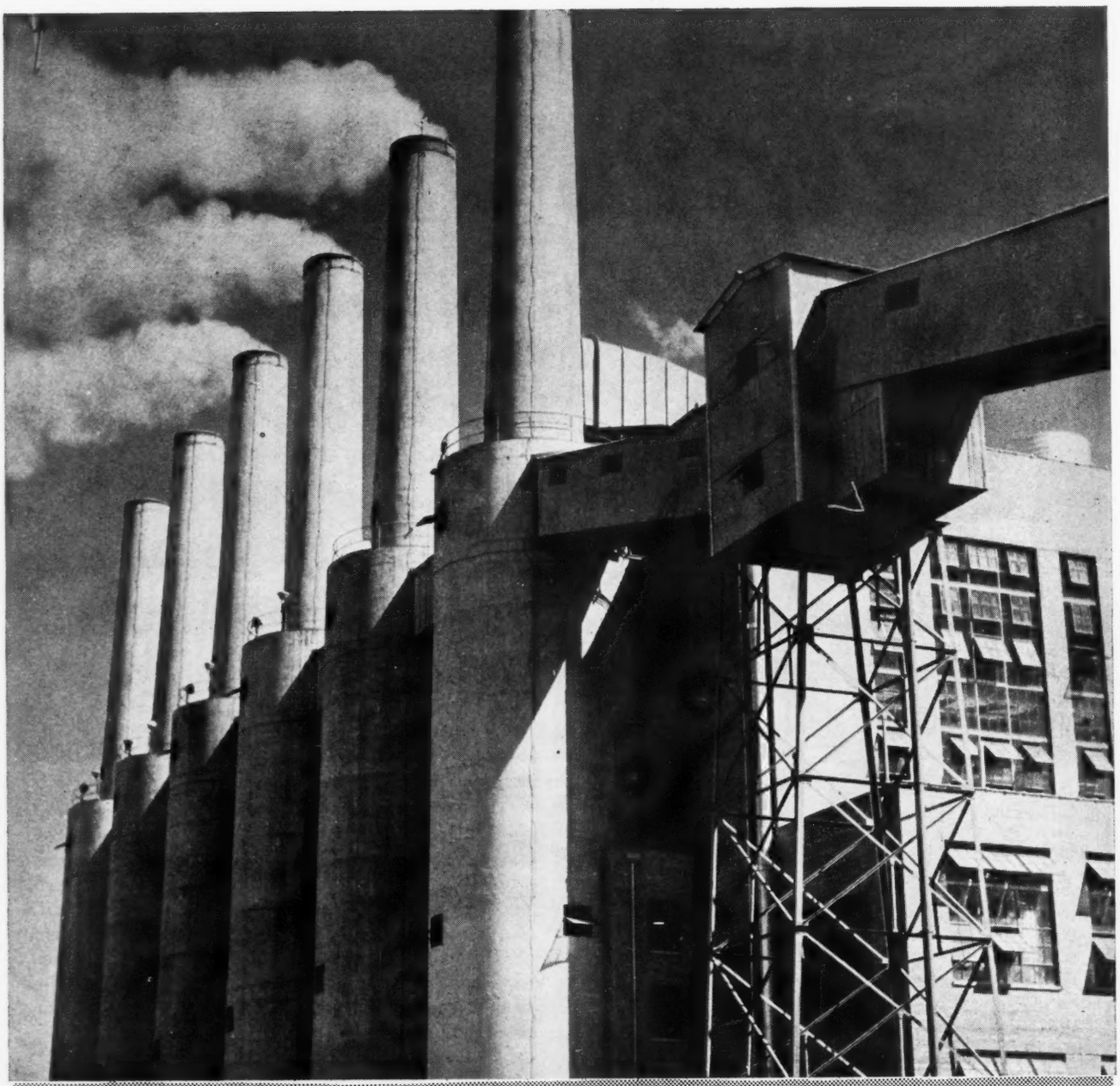
REEVES Motodrive provides full-range stepless speed variation on this Stokes Standard Press. This press capable of applying 100 tons pressure in forming plastic or powdered metal parts.



Lathe equipped with the new REEVES Machine Tool Drive. Note curve in sturdy bracket for proper clearance in mounting variable speed unit, in this case the REEVES Motodrive, horizontal design.



REEVES-driven Rotary Carburizer, manufactured by American Gas Furnace Co. Motodrive insures wide range of retort speeds and regulates retort speed for any desired heating period.



Carey HEAT INSULATION

HELPS GET MORE KILOWATTS FROM EXISTING EQUIPMENT

Of course, your power plant equipment is insulated. But much of this insulation is not up-to-date—not fully adequate to meet the demands of wartime production, now approximately 3½ billion kilowatts per week and almost certain to go higher.

Which suggests an immediate and thorough check of your insulated equipment to determine if further heat waste may be eliminated and power and fuel thereby conserved.

By their high efficiency and resistance to breakage under severe conditions, CAREY Insulations have won an enviable position in the power field. They meet every need of the industry, and have demonstrated the habit of paying back their cost in fuel saving, usually in a year or less.

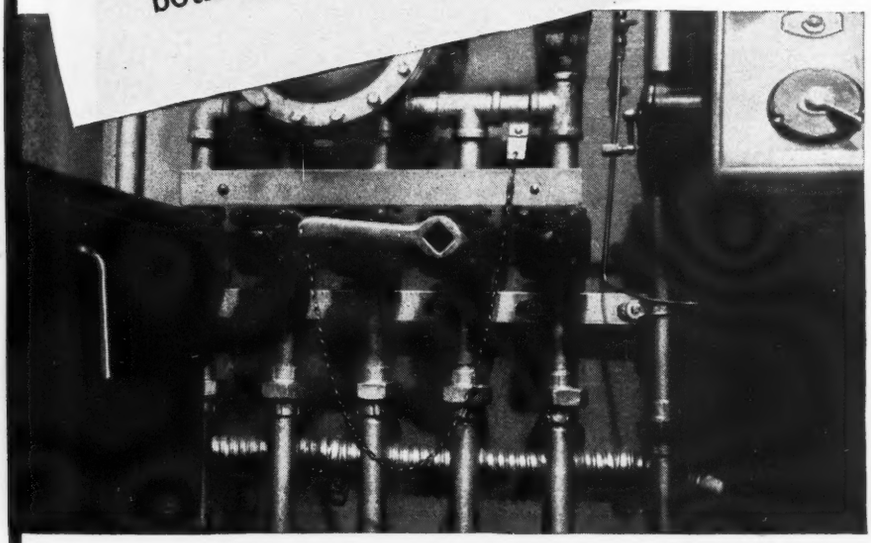
Kilowatts and fuel are too precious to waste. Insulations are too important for you to take chances with unproved products. Be SURE with CAREY. A nationwide organization is ready to serve you.

THE PHILIP CAREY MFG. COMPANY
Dependable Products Since 1873
Lockland, Cincinnati, Ohio
In Canada: The Philip Carey Company, Ltd.
Office and Factory: Lennoxville, P.Q.

SUBSTITUTE REGULAR VALVES for SPECIALS

...saves time and money

An actual case history of how one manufacturer's request for specials was met with *regular* valves — saving money and valuable man hours for both the customer and Walworth.



PROBLEM: A motor manufacturer required valves so designed that the fluid could pass at any time from but one of the 5 inlet lines to the common outlet. A special 6-way valve would have required special design, patterns, machining and an excessive number of man-hours.

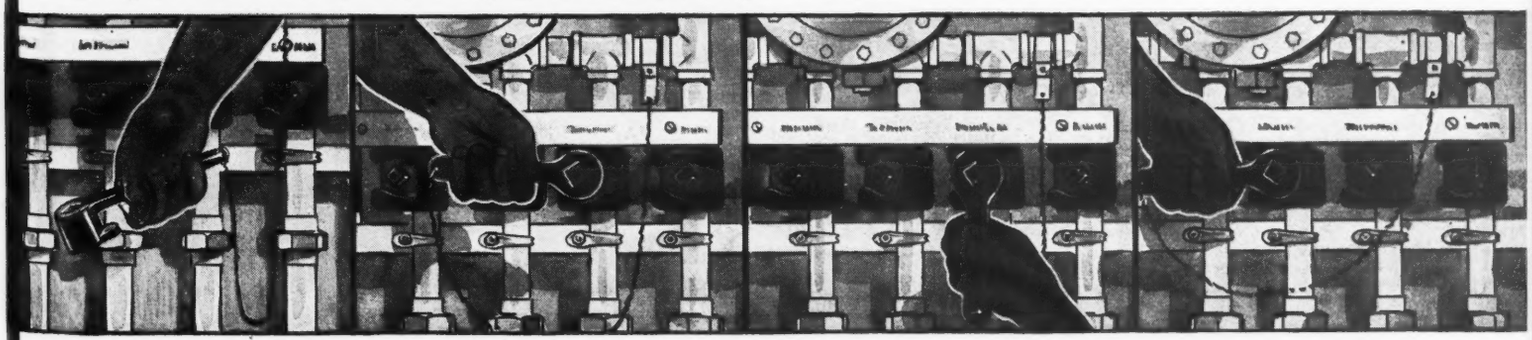
SOLUTIONS: Five regular Walworth Lubricated Plug Valves were suggested, arranged as shown in the photograph. Five lock-caps and only one handle were provided. The handle could be removed only when the valve was in the closed position. This arrangement assured positive shut-off of all valves and control of the valve in use. Moreover the handle clearly indicated which valve was in use.

If you have a *special* valve problem perhaps you can substitute *regular* valves. Call your Walworth Jobber. His experience is invaluable in helping with all your wartime valve needs.

WALWORTH 1842 1942 VALVES AND FITTINGS 100TH. ANNIVERSARY

Our centennial year. Instead of "birthday advertising" we present this advertisement in a sincere effort to help users of valves, fittings obtain maximum service from Walworth products.

HERE'S HOW REGULAR VALVES DID THE JOB



Only one wrench to open and close the 5 valves.

2 Only one way for the wrench to fit the valve.

3 ¼ turn to open. The wrench can be removed only when this valve is closed.

4 Ready to open another valve but sure that this will be the only open valve.

WALWORTH

VALVES FITTINGS and TOOLS Backed by 100 Years' Service

WALWORTH COMPANY
60 EAST 42nd STREET, NEW YORK

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Anytime

IN WAR OR PEACE—

you can depend on Morse Silent and Roller Chain Drives to provide capacity and stamina to keep maximum production rolling, free from costly maintenance or breakdowns.

Reliability and high efficiency in capacities from fractional to thousands of horsepower.

That is what all big production needs.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

for

DISTINGUISHED SERVICE

Our workers in the Bartlett Hayward Division at Baltimore are now privileged to wear this emblem, a mark of unusual honor and distinction.

It symbolizes the most respected and coveted award conferred by the United States Navy on civilians: the "E" for excellence in industrial production.

This award was recommended by the *Bureau of Aeronautics.* Only two other American industrial concerns have been so honored. It was given because of ingenuity in applying straight-line, mass-output methods to the production of catapults for launching airplanes from the decks of naval vessels, and because of substantially bettering scheduled deliveries.

We are proud of these employees whose unceasing efforts have been so dramatically recognized, just as we are proud of those who are now serving in the armed forces. This war is being fought in the factory as well as on the battle-front. Both jobs must be *well done.*

All over the country, thousands of fellow-employees in the Koppers organization are likewise engaged in helping to arm America. They are building by-product coke plants and processing plants, producing coal and its innumerable derivatives, coke, chemicals, treated timber products, piston rings, special metals, fabricated parts and other materials and implements needed in titanic quantities by The United Nations. To each of them, this Navy "E" will bring added inspiration and a new appreciation of the vital importance of his share of the job.

KOPPERS COMPANY **PITTSBURGH, PA.**

KOPPERS...THE INDUSTRY THAT SERVES ALL INDUSTRY

AMERICAN *"Self-Cleaning" Hand Operated* STOKERS

The Timely Solution for the FUEL OIL SHORTAGE PROBLEM

THOUSANDS of users of types and grades of fuel threatened by impending shortages are now about to make decisions on the best kind of protection to install before the heating season starts. Many will favor changing over to hand operated grates as the solution offering the advantage of MINIMUM INVESTMENT.

What may not be known is that this "minimum investment" will buy more than just ordinary grates. IT WILL BUY AMERICAN "SELF-CLEANING" HAND OPERATED STOKERS. Users report ability to maintain 14% CO_2 and carry loads as high as 150% to 200% of rated capacity with practically all kinds and sizes of bituminous coals. No electric or steam power is used. Power cost is zero.

There is no time to delay. Start now. Give us width and depth of furnace for quotation. We will be glad to help you make out proper applications for requesting a WPB rating to qualify for immediate delivery. *Write, wire or phone today!*

TERRITORIES FOR SALES ENGINEERS

Some territories are open for experienced sales engineers familiar with steam plant boilers and furnaces. Information on request. Please furnish record of your experience and references.

AMERICAN COAL BURNER COMPANY

FOUNDED 1918
Builders of Thousands of Overfeed Stokers

AMERICAN COAL BURNER COMPANY
Engineers
32-18 East Erie St., Chicago, Ill.

☐ Please mail descriptive literature.

☐ Send quotation on AMERICAN "SELF-CLEANING" HAND OPERATED STOKERS to fit the following furnace: Width..... Depth.....Kind of Boiler.....Size..... H.P.....

☐ I am interested in selling AMERICAN HAND OPERATED STOKERS

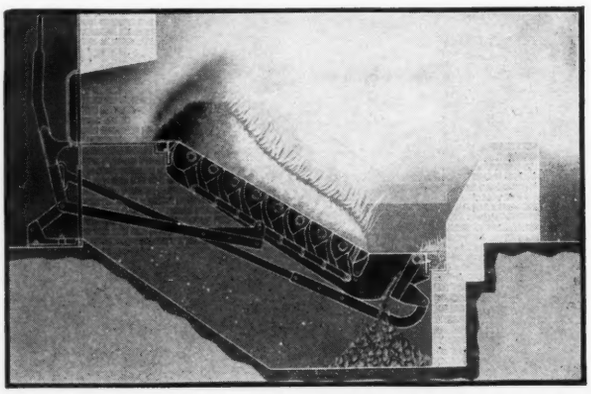
Name .....

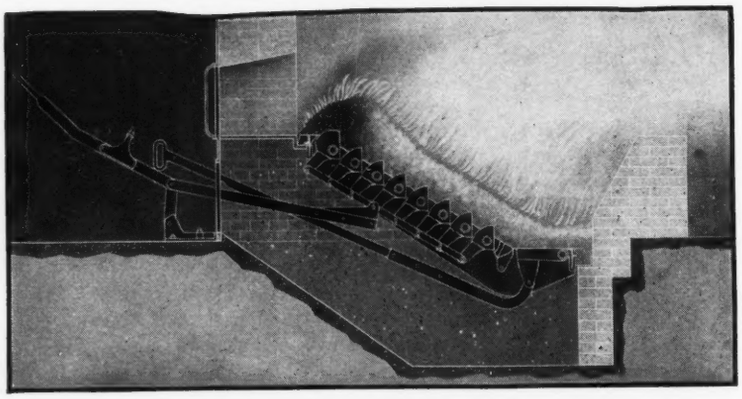
Company .....

Address .....

FEEDING

The coal is placed on the front of the stoker. Note the distillation of volatile gases from the green fuel at furnace front. The gas is completely consumed in passing over the hot coke in the rear.



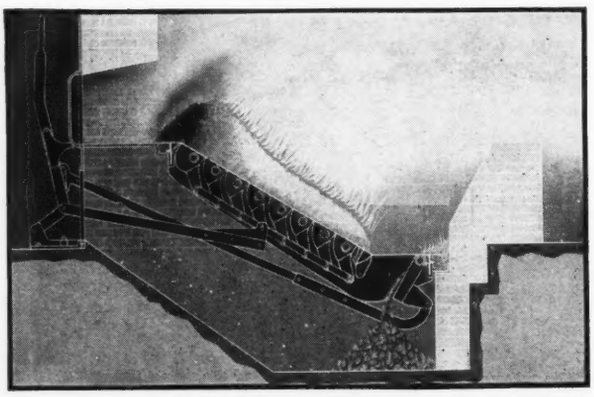


ONE LEVER DOES IT ALL!

An occasional pull on the lever advances the partially consumed coal towards the dump plate.

DUMPING

Dropping the dump bar releases the dump plate and discharges ashes into the pit without disturbing the fire. Simple, effective, fool-proof!



QUICK FACTS:

1 ANY SIZE. Sizes suitable for firing any quantity of coal from 100 lbs. to 4,000 lbs. per hour.

2 EASY TO ORDER. Just tell us the dimensions of the furnace. See coupon.

3 QUICK INSTALLATION. Put it in in a day's time.

4 MODERN FIRING METHOD. Employs the fundamental "Cokal" firing principle—the coking method which government engineers, smoke departments, and combustion engineers all recognize as the highly successful method for burning coal smokelessly and economically.

5 BURNS ANY COAL. Uses local coals and cheapest grades of bituminous coal of all sizes from dust to mine run. No clinkers.

6 EASY, SIMPLE OPERATION. No expert handling of shovel required. Scorching, back-breaking cleaning periods eliminated.

7 NO FANS, NO MOTORS — NATURAL DRAFT. Power failure or enforced "black-outs" will not affect the American Hand Operated Stoker.

Streamlined for Appearance

BALANCED FOR DEPENDABILITY

PLUS VALUES OF WORTHINGTON MONOBLOC PUMPS

- Hydraulically balanced to relieve pressure on stuffing box and reduce thrust
- Hand finished and balanced impeller . . . keyed to shaft for rigidity
- Pump and motor made for each other
- Moisture-proof and splash-proof motor standard equipment
- Extra-high pyramid type base prevents floor flooding . . . baseplate unnecessary
- Accessibility . . . ample room for inspection and adjustment of gland
- Large diameter one-piece shaft . . . prevents eccentricity in every moving part
- Extra-large shielded bearings for longer life

Engineered by Worthington as a single unit . . . pump and motor made for each other . . . the MONOBLOC Centrifugal Pump is an outstanding example of compact dependability. The first requirement of good engineering . . . simplicity of construction . . . assures the user of every Worthington MONOBLOC Pump long, trouble-free and efficient service at *low first cost*.

Worthington is the first manufacturer to build a complete line of truly MONOBLOC one-unit pumps ranging from ½ to 30 horsepower. Call a Worthington engineer from our nearest district office, or see our Distributor near you, for complete details. Write Worthington for Bulletin W-321-B14.

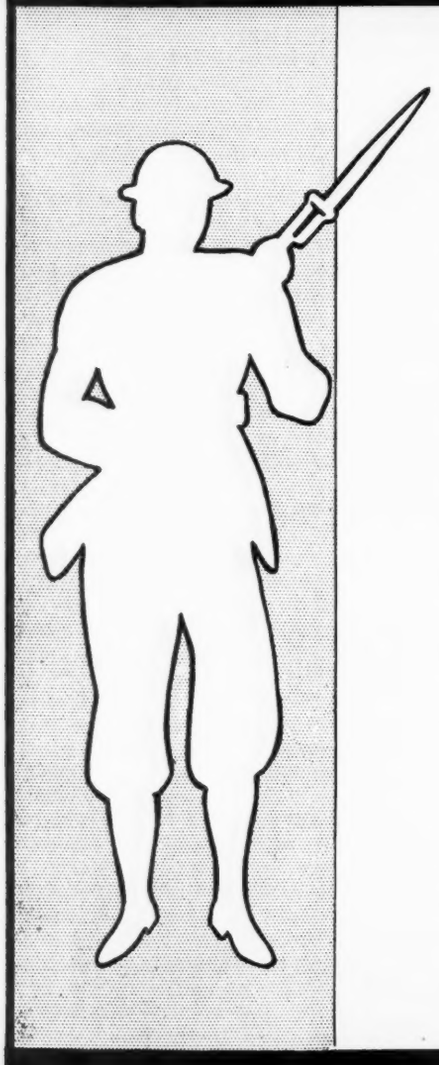
CP2-3

WORTHINGTON

MONOBLOC CENTRIFUGAL PUMPS

WORTHINGTON PUMP & MACHINERY CORPORATION • GENERAL OFFICES: HARRISON, N. J.

Defense against FUEL SHORTAGE



Complete stand-by fuel plant design, engineering and construction service is offered by this company—covering all the usual fuels

but featuring newly developed methods and fuels of unusual merit.

For action now, that will assure plant operation later—in any fuel emergency—write

J. F. PRITCHARD & CO.
DWIGHT BLDG. KANSAS CITY, MO.

BRANCH OFFICES IN TULSA, OKLA.; HOUSTON, TEXAS; ATLANTA, GEORGIA; CHICAGO, ILL.; PITTSBURGH, PA.; NEW YORK CITY

PRITCHARD STAND-BY FUEL SYSTEMS

At Your Service in any Emergency

"MAN-HOURS"
—the misleading measure of production

It requires but one eye to see that man-hours alone are no measure of production. The thing that counts is how much that man can produce in one hour.

ALTER EGO: Sure. By one method he may produce two or three times as much per hour as by another method.

Take arc welding. This method results in far greater effectiveness. In joining steel, one welder does the work of two, three or four men using other methods. And he does a better job with 15% to 25% less steel.

ALTER EGO: Then it would seem a better measure for a company's contribution to the war effort would be METHOD-HOURS.

True as gospel. Our whole war production has been zoomed by those who grabbed arc welding as the only way to save our national neck.

ALTER EGO: And later they'll be schooled in an art to save their individual necks when competitive production again seeks profitable markets.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

ALTER EGO: Literally, "one's other self"—the still, small voice that questions, inspires and corrects our conscious action.

then I said to myself—
IT'S METHOD-HOURS THAT COUNT!

You Get Double Life WITH

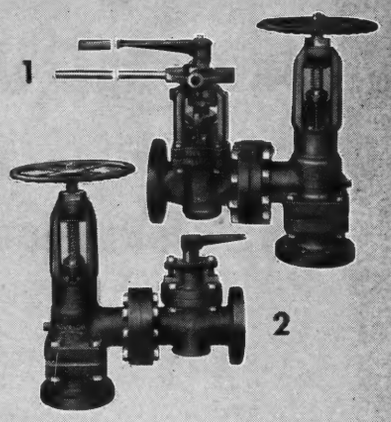
HOVALCO
BLOW-OFF VALVES

● Turn over the seat and disc of any Hovalco Angle Valve, and you have a "good-as-new" valve, ready to give double its length of service. And this *double valve life* is not just double that of an ordinary valve—but double the life of the HOVALCO'S extra-long-wearing Monel Metal seat and disc.

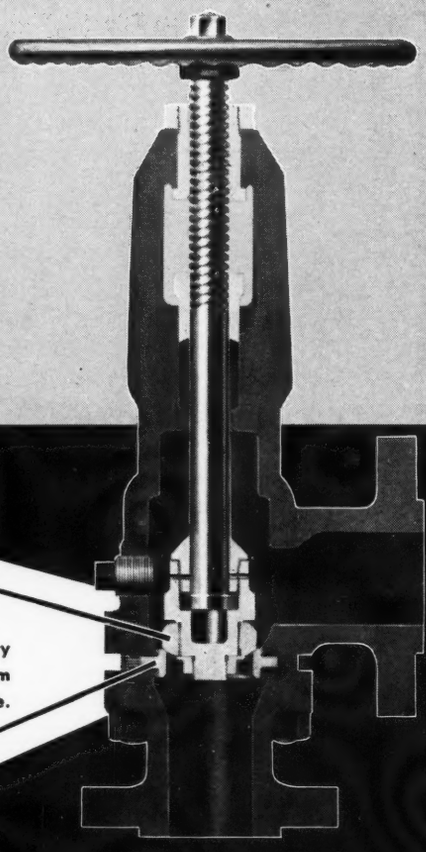
In addition, certified performance facts from users show that Homestead Boiler Blow-Off Valves give 30% to 60% lower maintenance costs.

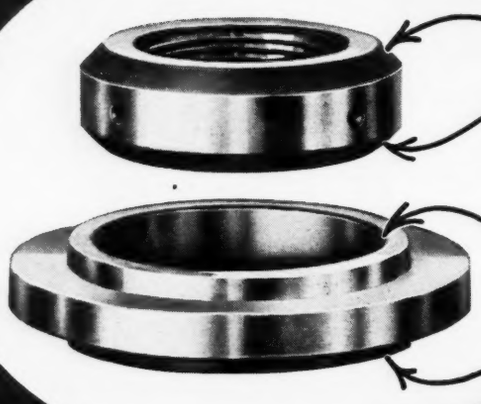
Here then is one sure way of meeting today's steadily increasing power demands with unfailing service and lower costs. Specify and order Homestead Valves for your next blow-off job; and for prompt delivery, please send the highest possible priority rating along with your order.

The proper size and type for your service conditions will be found in Reference Book No. 38. Write for it.



Hovalco Angle Valves, used in combination with (1) Homestead Lever-Seald or (2) Cam-Seald Quarter-Turn Valves, meet the requirements of A. S. M. E. Code and all state laws for boiler blow-off service. Made in 1½", 2" and 2½" sizes for pressures to 600 pounds.



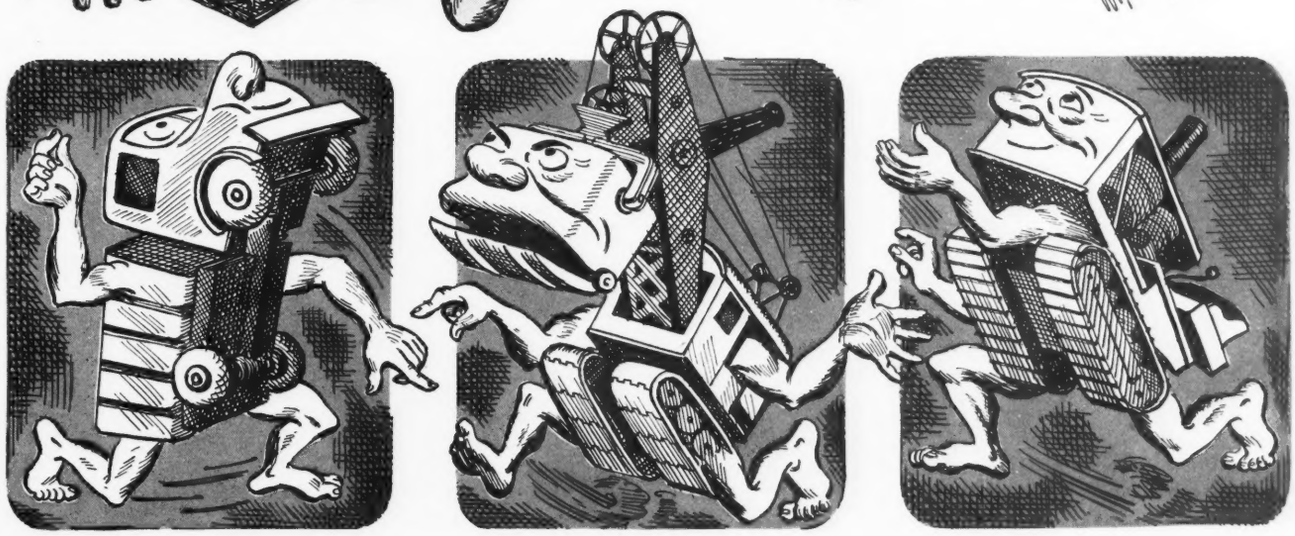


DOUBLE LIFE!
"Spare" seat and disc in every "HOVALCO." Simply turn them over for good-as-new valve.

HOMESTEAD VALVE MFG. CO.

MAKERS OF "PEAK PERFORMANCE" VALVES FOR 50 Years 1892 1942

P. O. BOX 210 • • • CORAOPOLIS • • • PENNSYLVANIA



"**Why should I?** I'm a truck with a *Cummins Diesel*—one of ten used by the Hinman Bros. Construction Company of Pittsburgh and Denver on the Letterkenny Ordnance Depot and Arlington Housing grading jobs. Altogether, we've gone 100,000 hours without an overhaul since we changed to a certain oil that eliminates sludge trouble. We keep going and feel fine because we lead *clean* lives!"

"**Naw**—tough going's easy for me. I'm a power shovel with a *Waukesha-Hesselman Diesel.* Hinman operates two of us on this same job, and we total 20,000 hours without an overhaul. Know why we don't bog down? Because we use the same oil—and it stops *ring-sticking* cold. It keeps us going strong!"

"**Rest? For what?** This heat doesn't bother me. I'm one of the 22 pieces of Hinman Bros. equipment with *Caterpillar Diesels.* All told we've gone 220-000 hours without an overhaul. Sure it's hot, but we use that oil too—and it sure *sticks to the hot spots,* so we get along swell!"

STANDARD OIL COMPANY OF CALIFORNIA

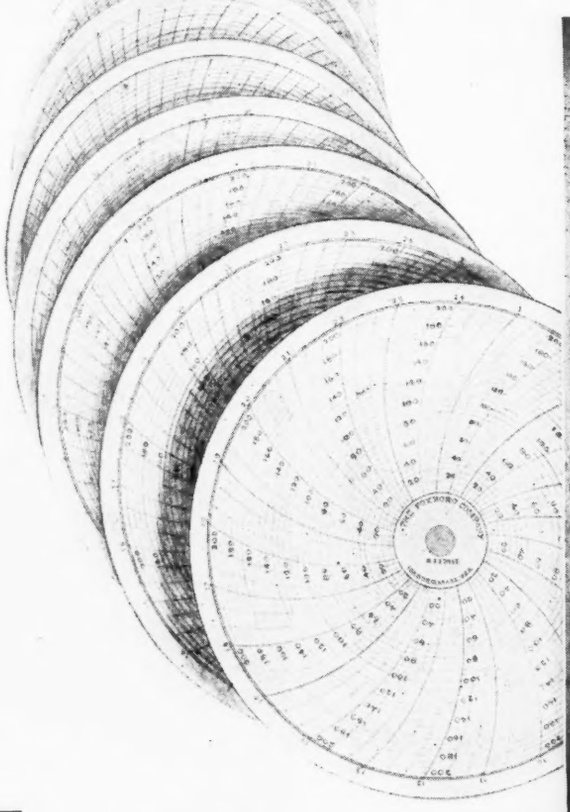
and if YOU want to keep going, old fellow, do as we do . . . . use RPM DELO!

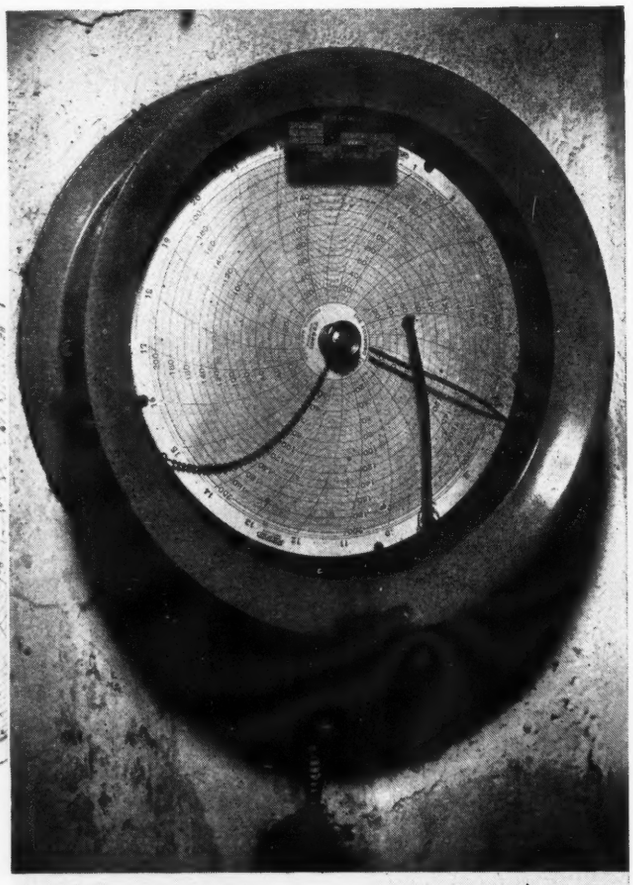
RPM DELO is marketed under the following names:

RPM DELO · Caltex RPM DELO · Kyso RPM DELO
Signal RPM DELO · Imperial-RPM DELO · Sohio RPM DELO
CONCENTRATE

Ask your Diesel engine manufacturer or distributor for the RPM DELO supplier in your vicinity

7,500 Days of CERTAINTY in Exacting Process Operation!





Every day for 25 years, Cleveland Fruit Juice Company has used this Foxboro Recorder to guide production!

That's what this veteran Foxboro Recorder gave to one manufacturer!

Ask the Cleveland Fruit Juice Company whether they consider it essential to keep *records* of processing conditions. Their own past practice gives the most conclusive answer!

Every working day for 25 years, this company has kept a continuous record of one critical process temperature. Simply through use of the Foxboro Temperature Recorder shown here, costly guesswork has been eliminated. And this veteran instrument is still in perfect calibration . . . still supplying exact production guidance every day!

No matter what part of your operation demands "close" control, its efficiency is bound to benefit from the certainty supplied by Foxboro Recorders. Automatically, you get the exact facts about each run to help you save steam, materials and costly re-runs. Uniformity can be assured.

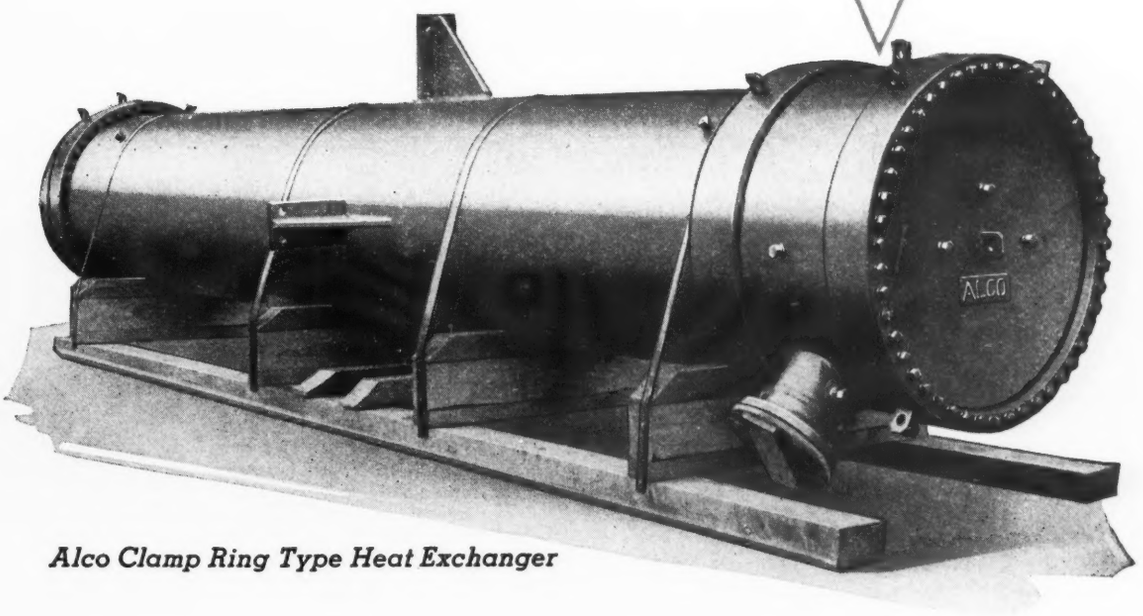
Write for detailed bulletins on Foxboro Recorders for Temperature, Pressure, Flow or Humidity . . . recorders that give sustained accuracy without servicing. **The Foxboro Company, 68 Neponset Avenue, Foxboro, Massachusetts, U.S.A.** Branches in principal cities of the United States and Canada.

FOXBORO
REG. U. S. PAT. OFF.
Instruments

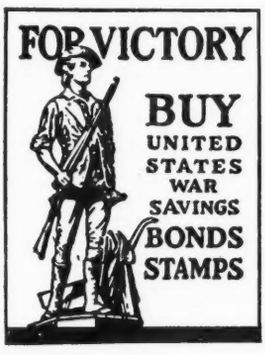
ALCO V

CLAMP RING JOINTS

—and the conservation of vital war materials



Alco Clamp Ring Type Heat Exchanger



In Alco Clamp Ring Construction there is 5 to 15% less steel* used than in other conventional designs. You have helped to save in excess of 500 tons of steel since Pearl Harbor by purchasing Alco Clamp Ring Type Heat Exchangers.

**Exclusive of tubes.*

AMERICAN LOCOMOTIVE COMPANY
ALCO PRODUCTS DIVISION
30 CHURCH ST., NEW YORK, N. Y. **DUNKIRK, N. Y.**

EVERY CUBIC FOOT OF AIR *has a job to do!*

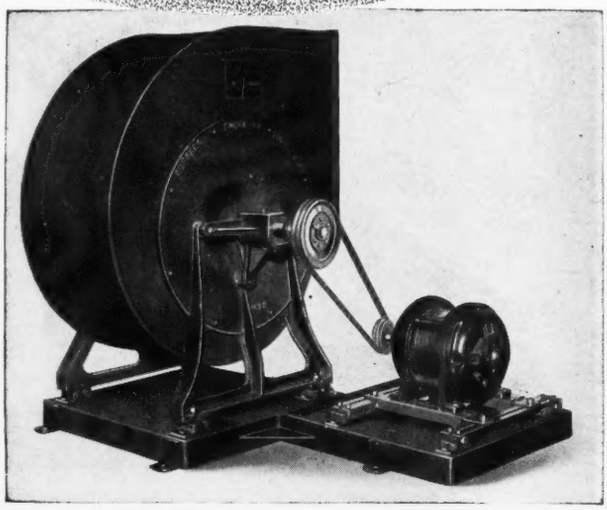
● There's no place for lazy air in today's stepped-up production program! Air—effectively controlled—helps speed up workers' efficiency thru correct ventilation and warmth . . . controlled air whisks away dust, dirt, corrosive fumes . . . controlled air provides unfailing draft to boilers. All vital services—all handled by built-for-the-job Buffalo Fans with dependability that can be counted on for years. Have you an air handling problem? Call in Buffalo.

BUFFALO FORGE COMPANY

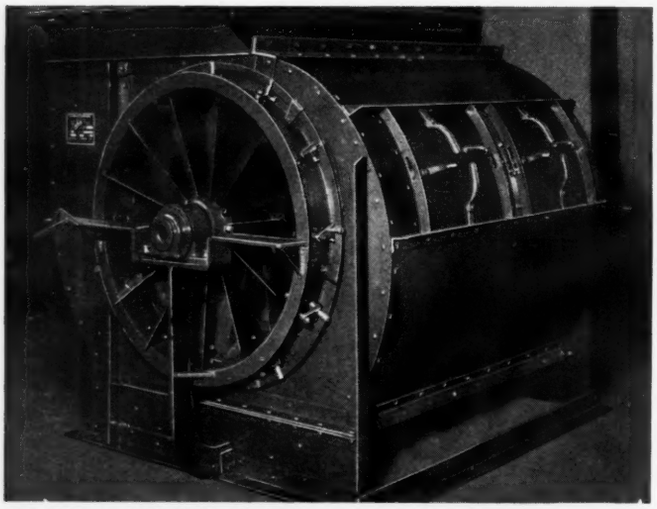
488 Broadway **Buffalo, N. Y.**

Branch Engineering Offices in Principal Cities

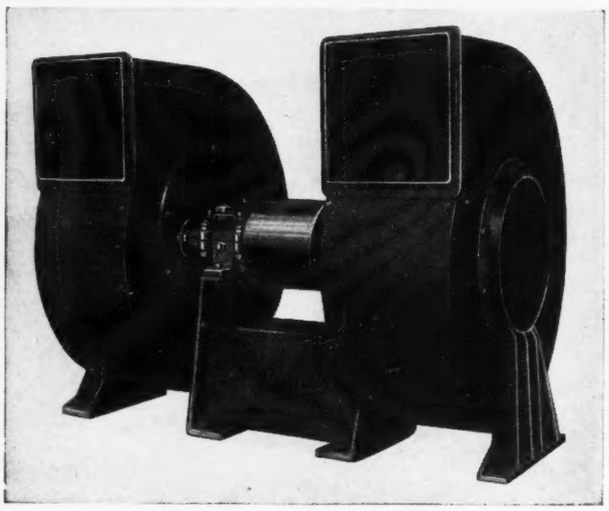
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.



VENTILATION. Ventilating and air conditioning fans should operate quietly, smoothly. Buffalo Limit-Load Fans have those characteristics plus high efficiency. Bulletin 3099.



FORCED & INDUCED DRAFT. Fans for this all-important service must have flexibility of control *plus* dependability. You find these features in Buffalo Fans. Bulletin 3113-A.



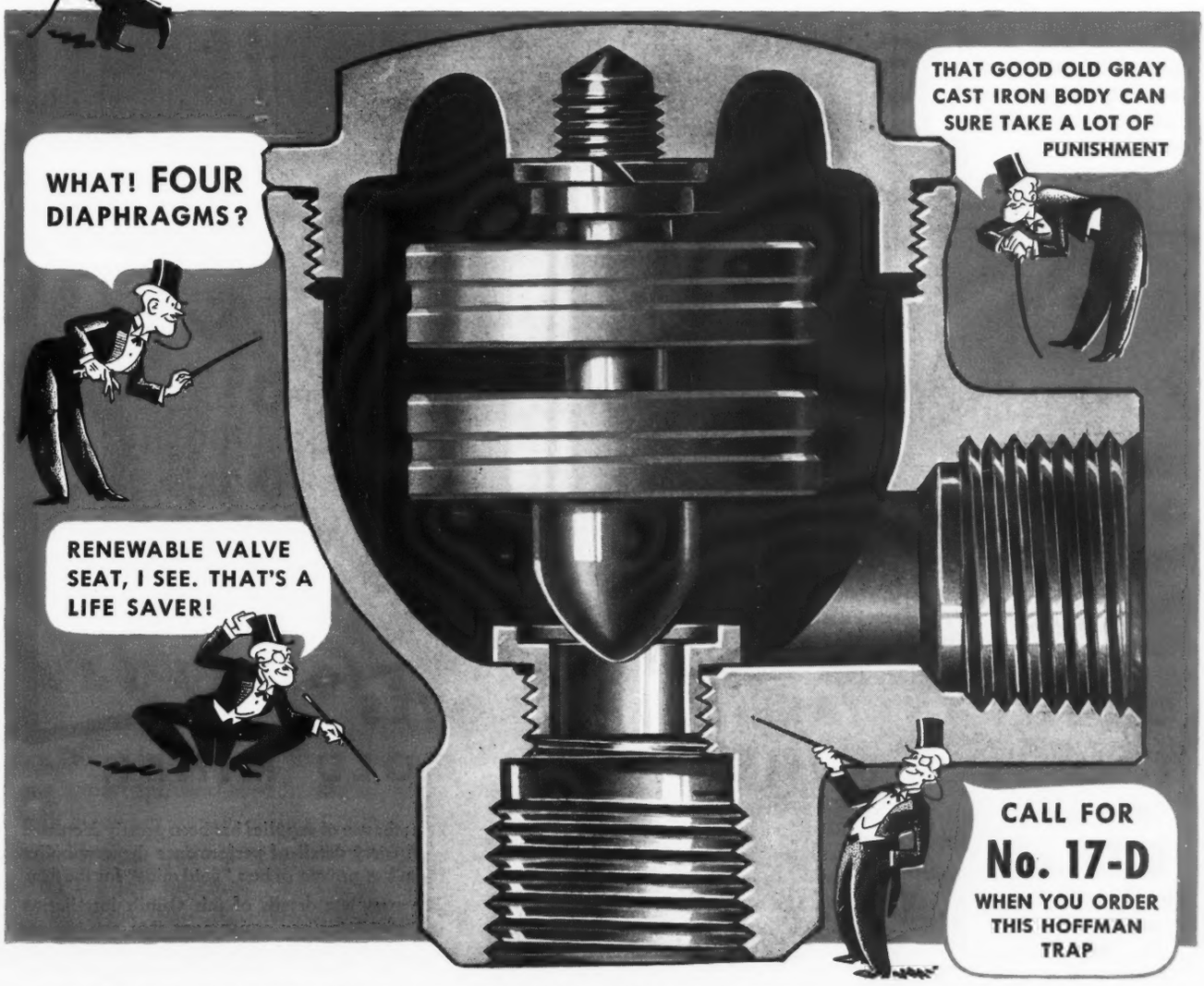
DUST OR FUME REMOVAL. Buffalo Steel Plate Exhausters are designed to handle waste materials efficiently. Special metal construction or rubber lining when necessary. Bulletin 2678-C.

"Buffalo" FANS FOR INDUSTRY

CAST IRON GOES HIGH HAT

...TO SAVE CRITICAL MATERIALS

Precious war metals conserved in this new trap . . . but still the same old Hoffman excellence of design, workmanship and performance . . .


WHAT! FOUR DIAPHRAGMS?
THAT GOOD OLD GRAY CAST IRON BODY CAN SURE TAKE A LOT OF PUNISHMENT
RENEWABLE VALVE SEAT, I SEE. THAT'S A LIFE SAVER!
CALL FOR
No. 17-D
WHEN YOU ORDER THIS HOFFMAN TRAP

The War Production Board told us what metals could be used—we designed to meet the specifications. So here's the new No. 17-D Trap, built with a minimum of critical materials, simplified, but retaining all the well-known Hoffman efficiency features.

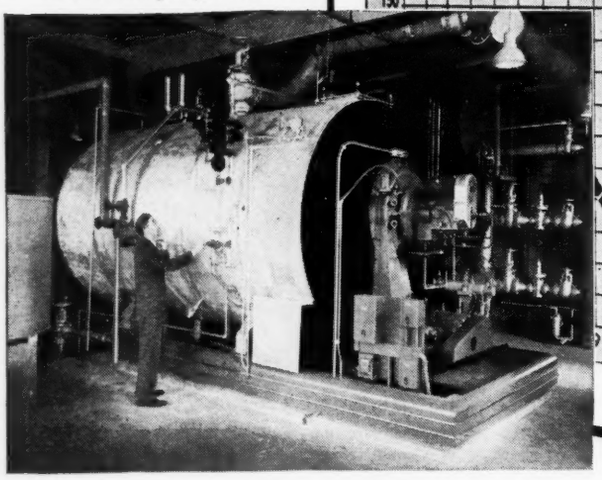
Hoffman No. 17-D Trap is built not only to operate efficiently, but to *last!* Body and cap are of fine quality gray cast iron. Note the Thermal Element—not two but *four* non-corrosive Adnic diaphragms, full of spring, long-lived under countless flexings and high temperatures. The Pin is of tough special alloy—and the entire thermal assembly can be renewed.

That goes for the Seat, as well. If long use should cause wear at this point, simply unscrew the Seat and insert a new one. To all practical purposes, you'll have a new trap at minor expense. Other specifications: ½" x ½" connections, with left hand thread on inlet, operating pressure 15 lbs. and capacity 200 sq. ft. E.D.R.

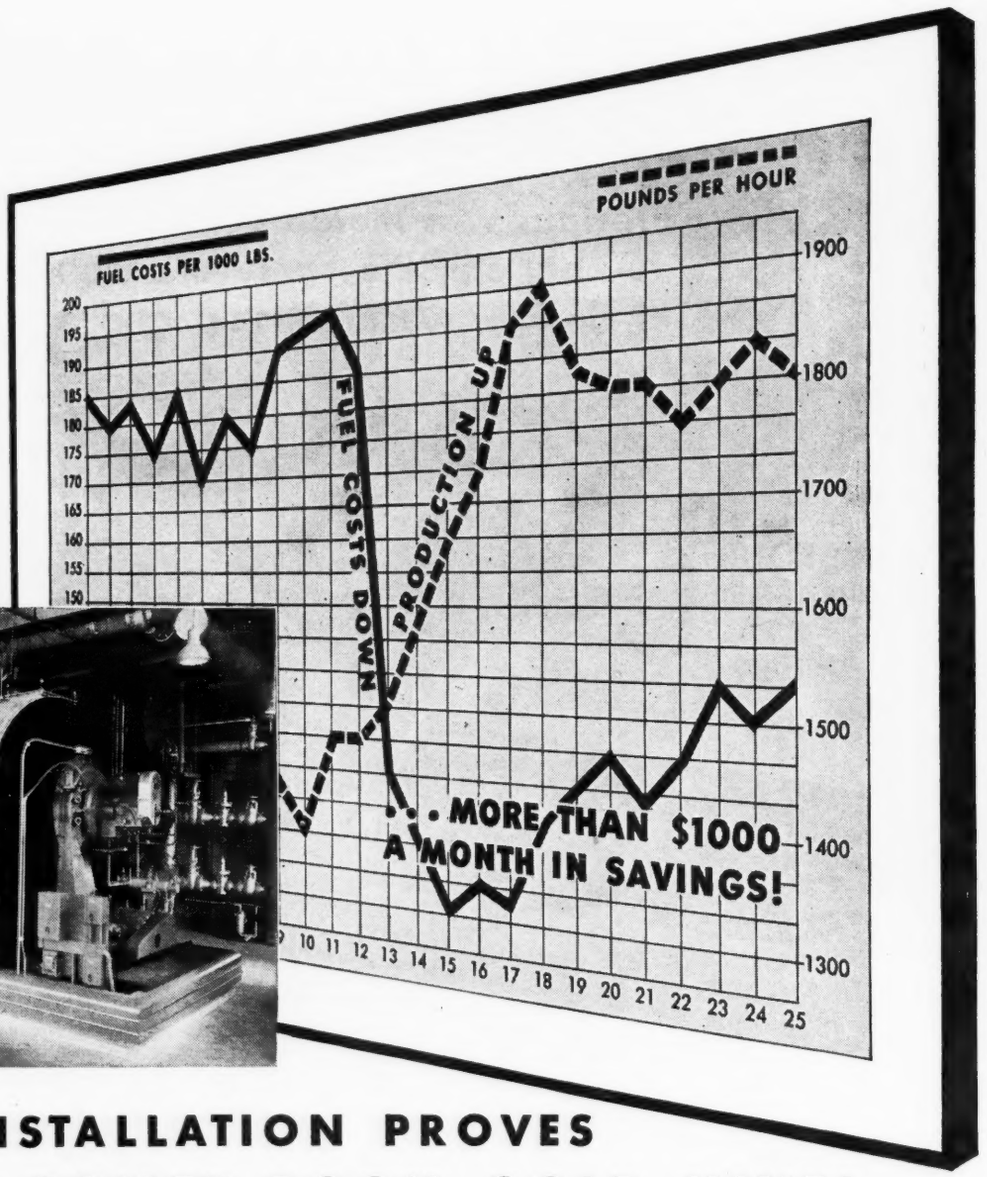
Use the No. 17-D Trap for emergency repairs under the terms of Government Order P-84. And, of course, on direct war work, U. S. Government buildings, barracks, hospitals, defense plants, etc. For further information, write the Hoffman Specialty Company, Dept. P-8, 1001 York St., Indianapolis, Indiana.

HOFFMAN VALVES TRAPS PUMPS

Hoffman Steam and Hot Water Specialties are sold everywhere by leading wholesalers of Heating and Plumbing equipment.



• *Oilbilt of the type installed in the plant of the Wolf Sanitary Wiping Cloth Company, Detroit.*



OILBILT INSTALLATION PROVES TO BE A BOILER-ROOM GOLD MINE!

HERE is another notable instance of boiler room modernization with an Oilbilt steam plant and auxiliary equipment which resulted in phenomenal savings.

The Wolf Sanitary Wiping Cloth Co., Detroit, specializes in the volume laundering of wiping cloths—ships as much as 100,000 pounds of clean wiping cloths a week. The Oilbilt steam plant, installed last year, provides steam for processing, for a generator set, and for general plant heating.

Better steam — at lower cost — provided by the Oilbilt—has enabled this firm to achieve savings of well over $1000 a month, compared to previous equipment in service. Production has been increased, working time cut down, formulas shortened; there is softer, hotter water and more of it; the use of supplies has been greatly decreased —in every detail of performance the new boiler room has proven to be a "gold mine" for the firm.

The complete details of this Oilbilt installation and the auxiliary equipment that account for this remarkable boiler room efficiency, are available in a special report, as published in the American Laundry Digest. Write for a copy.

Modern in every detail and embodying the best engineering practice and principles, OILBILT steam plants eliminate ashes, coal dust, smoke, a high expensive stack. Fuel costs are lowest because of Oilbilt's high thermal efficiency; Oilbilts are specifically designed for efficient oil-firing with a long, four-pass, down-draft flue travel and integral burner. Built in sizes 20 to 500 hp.; pressures 15 to 200 lbs. Write for bulletin.

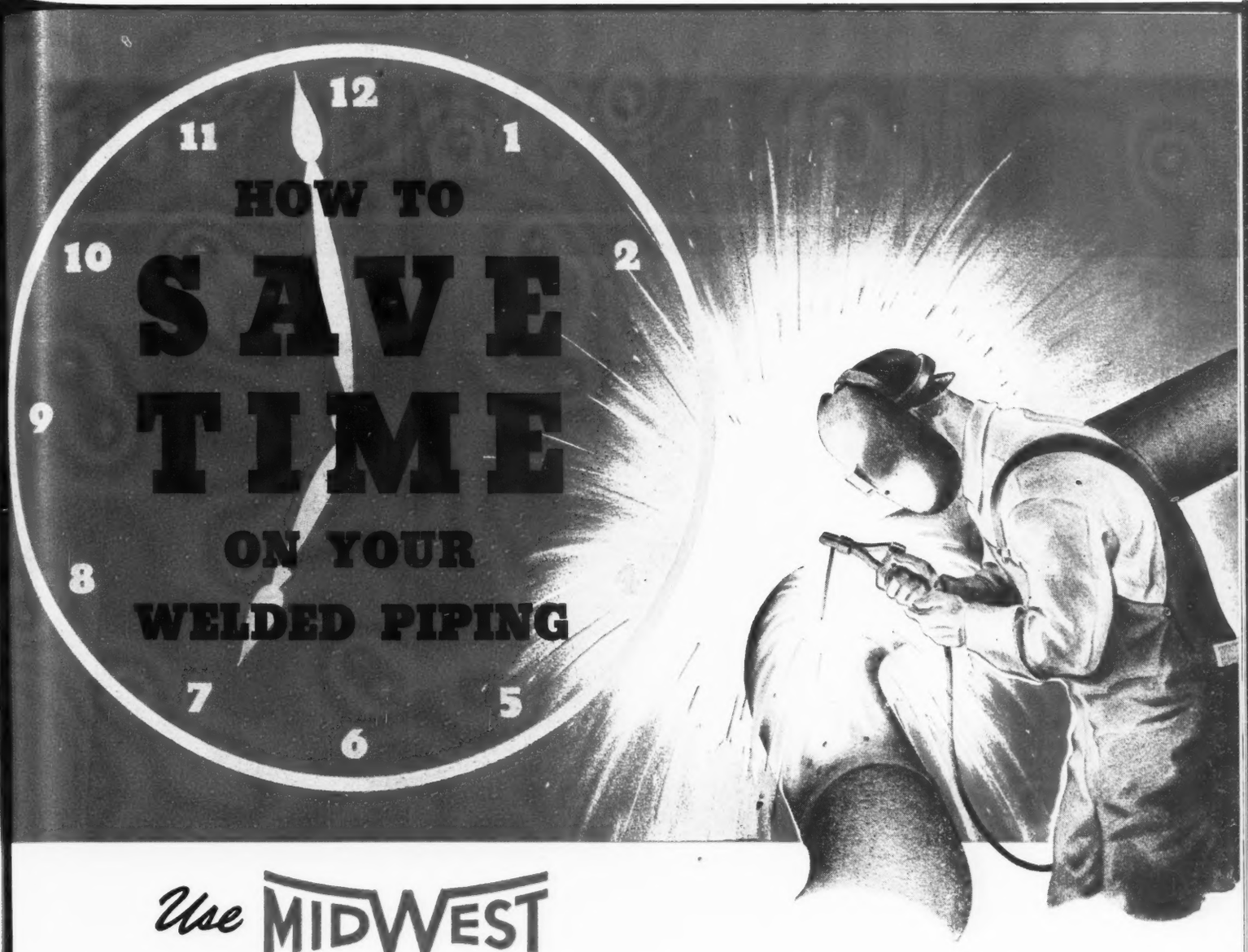
★

Greatly enlarged Cleaver-Brooks manufacturing facilities are going "'round the clock" for military and priority industry demands. Naturally this "Victory" effort comes first, but we welcome non-preference inquiries.

★

CLEAVER-BROOKS COMPANY, 5109 N. 33rd Street, Milwaukee, Wisconsin

Oilbilt STEAM PLANTS

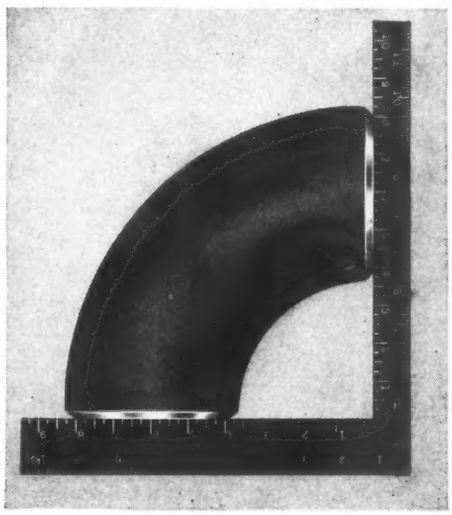


Use MIDWEST
WELDING FITTINGS

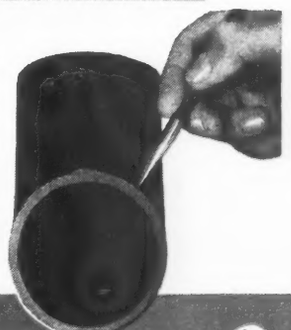
Now that "time" is the critical factor on so many welded piping jobs, it is more important than ever before to utilize the time-saving characteristics of Midwest Butt-Welding Elbows.

Qualified pipe welders report that Midwest Elbows save time and trouble on the job because they are always accurately to dimension . . . and because they are always uniform. Time is saved not only in lining up and in welding, but also because all pipe can be cut in advance according to drawings. Another important advantage is that more uniform welds are assured.

These features result from the design and from the unique process used in the manufacture of Midwest Welding Elbows. They are first made slightly oversize . . . then accurately sized in compression at a forging heat. Special fixtures and machine tools assure accurate finishing. Ask for Bulletin WF-41 which gives all the facts.



(above) Exact included angle is the result of special fixtures and tools developed by Midwest for machine-beveling the ends.



(right) Sectional view emphasizes uniform wall thickness and true circular cross-section of all Midwest Welding Elbows (both Standard and "Long Tangent").

MIDWEST PIPING & SUPPLY CO., Inc.

Main Office: 1450 So. Second St., St. Louis, Mo.
Plants: St. Louis, Passaic (N. J.) and Los Angeles

Sales Offices: Chicago—949 Marquette Bldg. • New York (Eastern Division)—30 Church St. Los Angeles—520 Anderson St. • Houston—229 Shell Bldg. • San Francisco—535 Call Bldg. Tulsa—533 Mayo Bldg.

MIDWEST WELDING FITTINGS SAVE TIME, IMPROVE THE DESIGN, AND REDUCE THE COST OF PIPING SYSTEMS

MORE POWER from

FOR BETTER ATOMIZATION

Installation of an efficient atomizer at the proper point in your steam line will aid materially in securing better oil atomization.

Texaco Lubrication Engineers will gladly assist you in the installation of such an atomizer and the selection of the proper steam cylinder oil.

Cutaway view showing the method of installing Bowser terminal check valve and atomizer quill.

SIMPLE FILM TEST

Best test of effective cylinder lubrication is examination of cylinder walls, valves, etc., where oil film should be sufficient to give the time-honored brownish stain through 3 or 4 thicknesses of cigarette paper.

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

TEXACO

TEXACO
REG. T. M.

your PRESENT engines

WAR-TIME power demands have put hundreds of standby steam engines back on the line . . . made vital the need for uninterrupted, maximum output from *every* available power source.

Hundreds of reciprocating steam engines are delivering dependable power . . . with low oil consumption . . . because lubricated with *Texaco Steam Cylinder Oils.*

There is a suitable grade of *Texaco Steam Cylinder Oil* to meet every condition of temperature and pressure. These oils atomize completely, adhere to cylinder walls, separate rapidly from the exhaust.

The outstanding performance that has made Texaco preferred in the fields listed in the panel has made it preferred by prominent steam engine operators everywhere.

These Texaco users enjoy many benefits that can also be yours. A Texaco Lubrication Engineer will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distribution points in the 48 States, or write: The Texas Company, 135 East 42nd Street, New York, N. Y.

Care for your Car ..for your Country

THEY PREFER TEXACO

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

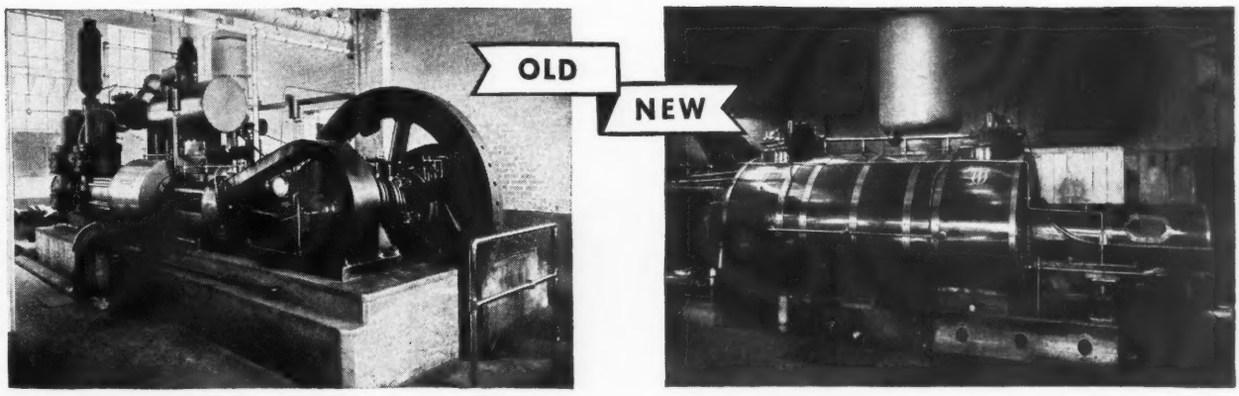
★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

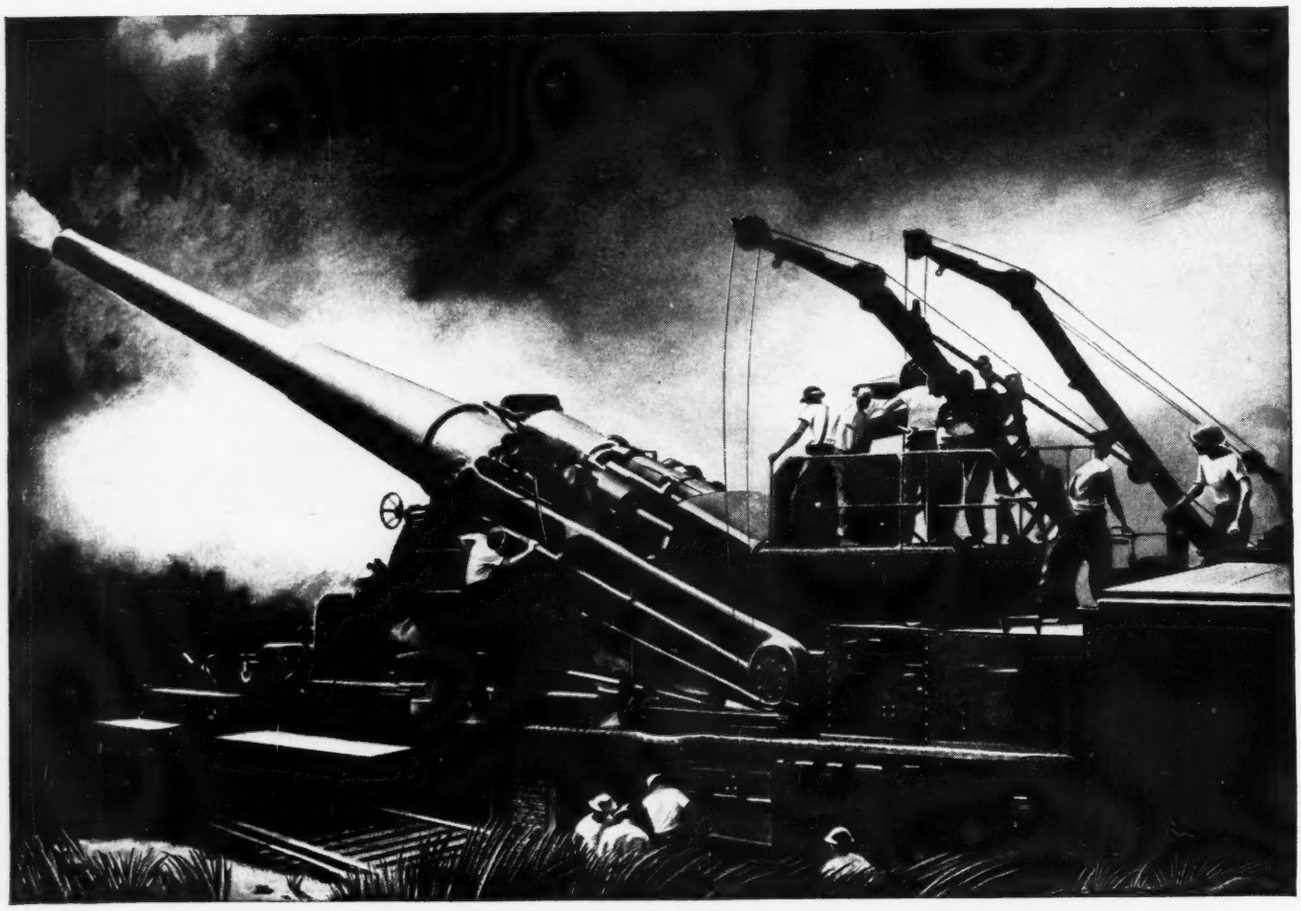
Tune in the TEXACO STAR THEATRE every Sunday night—CBS



. . . high pressure or low . . . super-heated or saturated steam . . . exhaust or condensate that must be oil-free . . . there is a Texaco Steam Cylinder Oil exactly suited to your needs.

Lubricants and Fuels

FOR POWER PLANT EQUIPMENT



Feeding War Dogs

ANOTHER JOB FOR WICKWIRE ROPE

We'll be glad when it's over . . . when Wickwire rope can get back to the jobs of a world at peace.

The quickest way from here to there is for us, and for you, each day *now*, to put everything we have into winning.

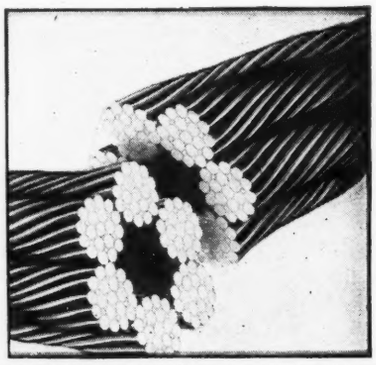
We are doing it by working day and night, seven days a week, on Wickwire Rope for our shipyards, our Liberty Fleet, the army, marine corps, coast guard and navy . . . and for industries whose production is so urgently needed.

You are contributing when you take care of your wire rope, making it last longer . . . so that there is more available for war needs.

But when you *must* have new wire rope, for war production or for essential services, ask your distributor for long-life *Wickwire* Rope. Both Wickwire regular lay and pre-formed Wissco Lay have quality that has made them famous for *low cost per year of use*. We put that into Wickwire rope by controlling every step from ore pile, through blast furnaces, open hearths, precision wire drawing, and skillful laying of the rope.

• • •

A FREE BOOK, "Know Your Ropes," is waiting here for you. More than 25,000 wire rope users all over the world consider this a bible on the selection of wire rope—*and making it last longer.* Write Wickwire Spencer Steel Company, 500 Fifth Ave., New York, N. Y.



REVERSE ROPE FOR LONGER LIFE
Frequently, most severe strain, due to close bending, occurs near one of the ends. Rope life is increased by exchanging the drum end with the load end. This and forty more rope life-savers are fully described in the free book, "Know Your Ropes."

SEND YOUR WIRE ROPE QUESTIONS TO WICKWIRE SPENCER

WICKWIRE SPENCER STEEL COMPANY

WICKWIRE ROPE

Sales Offices and Warehouses: Worcester, New York, Chicago, Buffalo, San Francisco, Los Angeles, Tulsa, Chattanooga, Houston, Abilene, Texas, Seattle. Export Sales Department: New York City

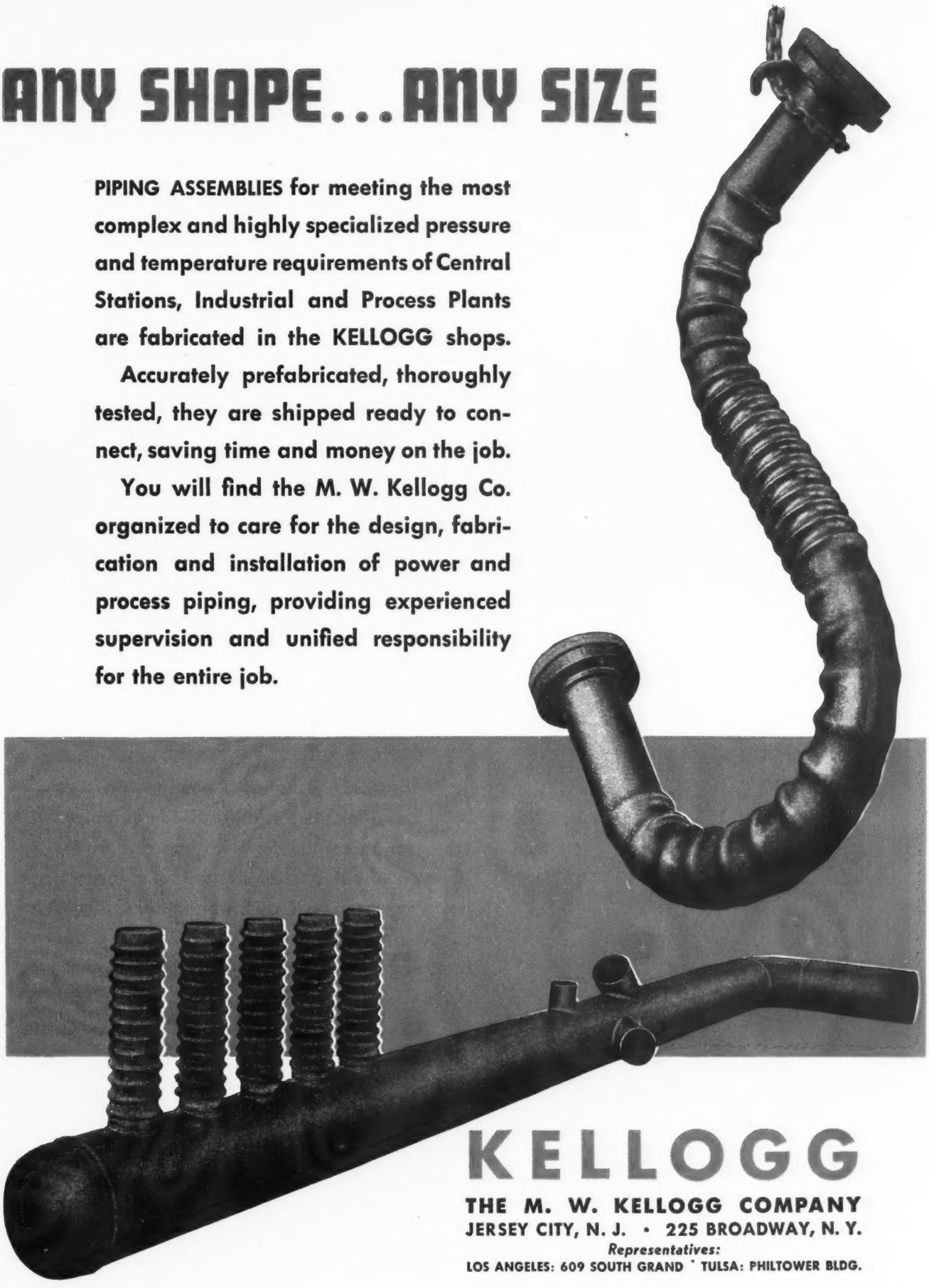
WISSCO PRODUCTS

ANY SHAPE...ANY SIZE

PIPING ASSEMBLIES for meeting the most complex and highly specialized pressure and temperature requirements of Central Stations, Industrial and Process Plants are fabricated in the KELLOGG shops.

Accurately prefabricated, thoroughly tested, they are shipped ready to connect, saving time and money on the job.

You will find the M. W. Kellogg Co. organized to care for the design, fabrication and installation of power and process piping, providing experienced supervision and unified responsibility for the entire job.

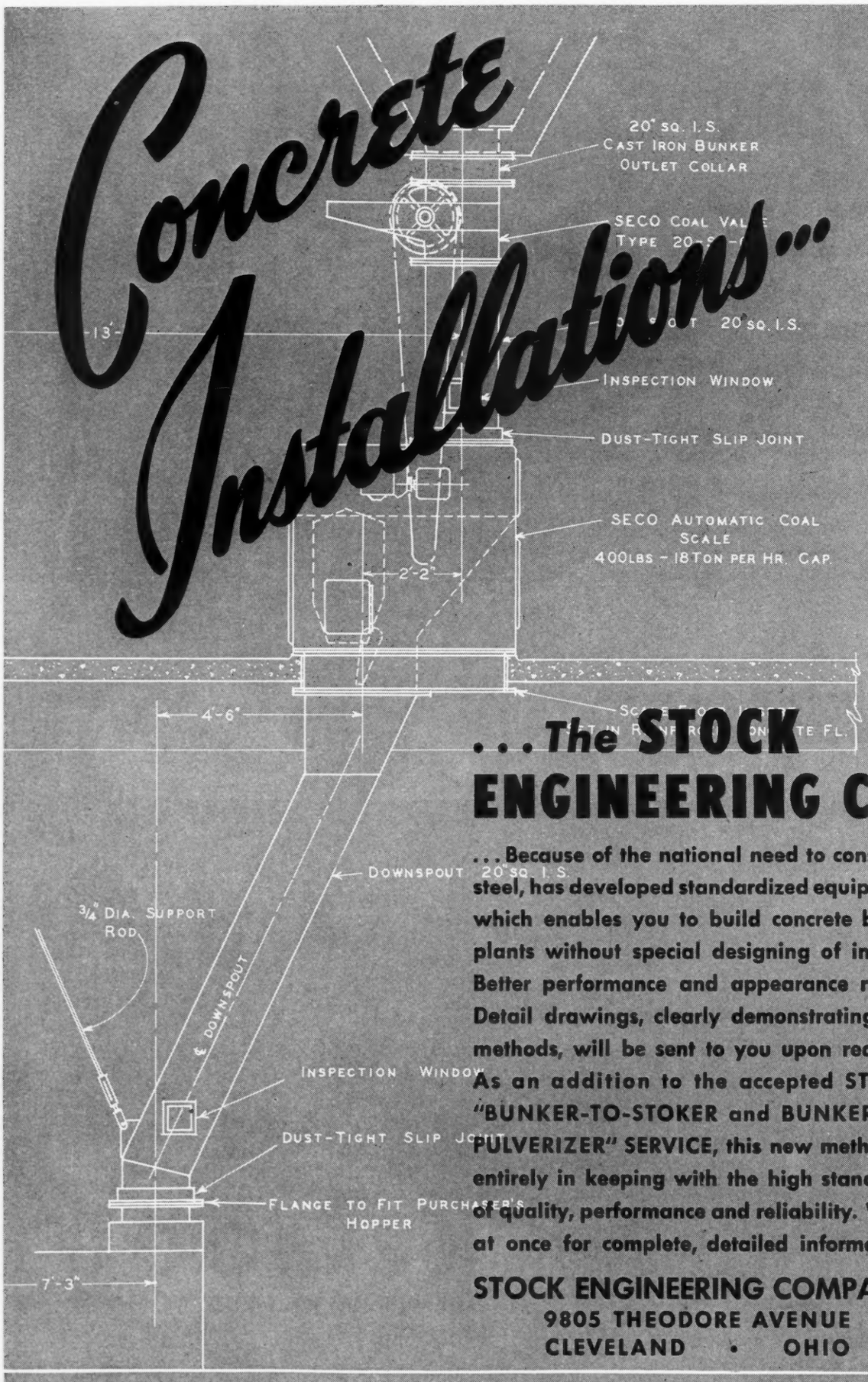


KELLOGG

THE M. W. KELLOGG COMPANY
JERSEY CITY, N. J. • 225 BROADWAY, N. Y.
Representatives:
LOS ANGELES: 609 SOUTH GRAND • TULSA: PHILTOWER BLDG.

"Masterflex" Prefabricated Piping Systems • **"Masterweld"** pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Reforming, Dehydrogenation, Alkylation, Desulphurization, Thermal and Catalytic Polymerization Units **JUIK Processes** for Lubricating Oil Plants. Plastic Refractories • Radial Brick Chimneys.

Concrete Installations...



...The STOCK ENGINEERING CO.

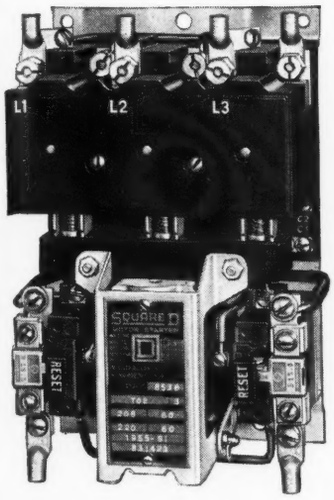
...Because of the national need to conserve steel, has developed standardized equipment which enables you to build concrete boiler plants without special designing of inserts. Better performance and appearance result. Detail drawings, clearly demonstrating our methods, will be sent to you upon request. As an addition to the accepted STOCK "BUNKER-TO-STOKER and BUNKER-TO-PULVERIZER" SERVICE, this new method is entirely in keeping with the high standards of quality, performance and reliability. Write at once for complete, detailed information.

STOCK ENGINEERING COMPANY
9805 THEODORE AVENUE
CLEVELAND • OHIO

COAL VALVES • COAL SCALES • COAL DISTRIBUTORS • COMPLETE "BUNKER-TO-STOKER AND BUNKER-TO-PULVERIZER" INSTALLATIONS

Complete Accessibility

means faster, easier servicing of motor starters

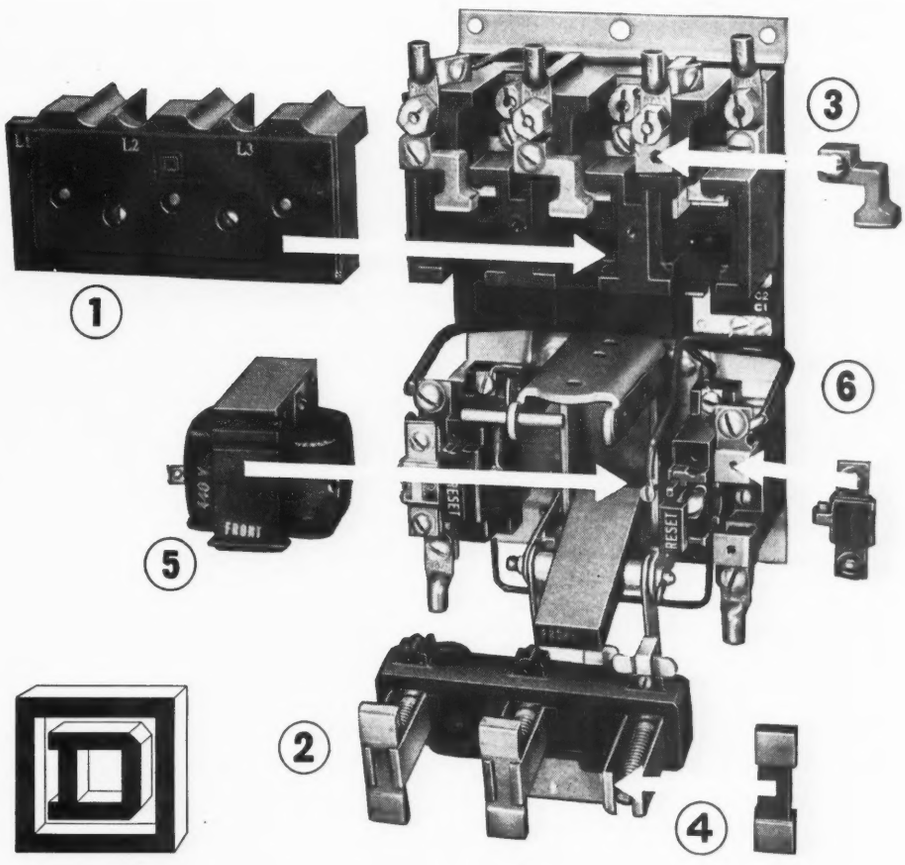


All renewable parts of Square D AC electric motor starters can be inspected or replaced in a matter of seconds—using only a screwdriver

Top operating efficiency and long life of electric motor starting equipment depend largely on regular inspection and occasional servicing.

Today—with every minute at a premium—this inspection and servicing job is more important than ever to avoid time-wasting breakdowns.

Square D Class 8536 AC magnetic starters, with their simple compact construction and vertical action, are completely accessible. An electrician, without special tools, can exchange magnet coils, contacts or overload relay units—in practically no time at all.



1 Both stationary and movable contacts are exposed for inspection by merely loosening two screws and removing the arc chamber cover.

2 With cover removed, movable contact yoke bar can be swung forward to uncover operating magnet and coil.

3 Each stationary contact is held in place by a single screw. Removal does not disturb line or load connections.

4 Movable contacts can be turned 90° and removed from retaining clips without tools. Movable as well as stationary contact tips are silver—require no cleaning or dressing.

5 With coil connections removed, magnet frame and coil are lifted out by sliding locking clips and retaining pin out of position.

6 Clearly marked melting alloy type thermal overload relay units—interchangeable to suit motor characteristics—are easily attached at either side of the starter. Heater, melting pot, and ratchet wheel comprise an integral unit. Repeated tripping causes no deterioration and no parts need to be renewed following overload.

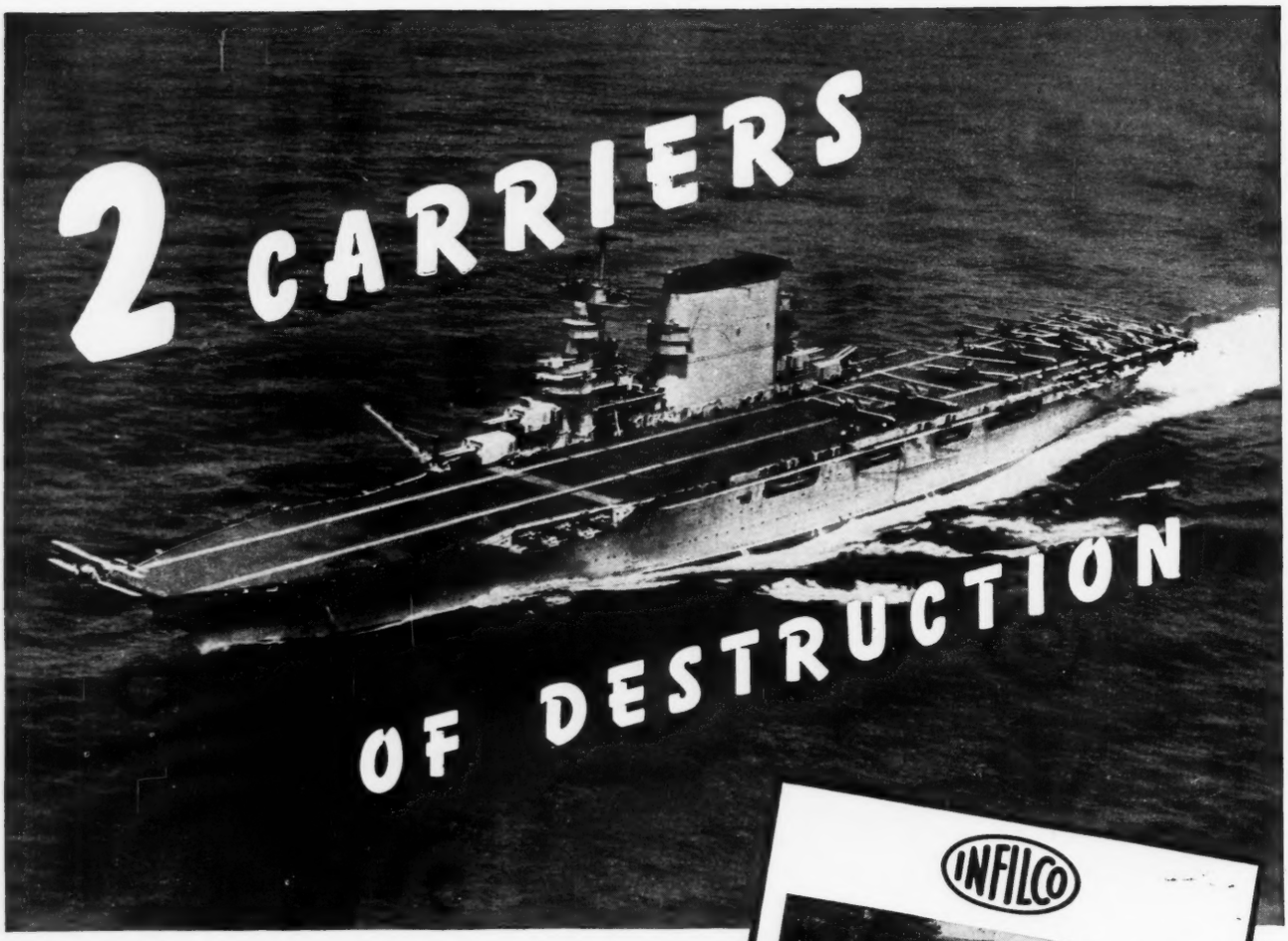
WRITE FOR BULLETIN 8536

SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO



Spectacular and instantaneous destruction results from the explosion of a Navy Bomber's torpedoes.

Destruction that is silent . . . perhaps slow . . . but nevertheless sure . . . can be carried by water into vital spots of your power plant.

Water . . . unless conditioned against scale, corrosion, embrittlement, oil, etc. . . . can destroy power plant equipment, efficient operation and fuel as effectively as a bursting torpedo.

Power plants, vital to the War Effort, are offered the protection of Infilco equipment for boiler and evaporator feedwater treatment, condensate oil removal, steam purification, cooling water conditioning, etc. The engineering staff and manufacturing facilities of this 48-year old organization are at your service.

INFILCO
INCORPORATED

325 W. 25TH PLACE, CHICAGO, ILL.
***Formerly* INTERNATIONAL FILTER CO.**

INFILCO

WHAT makes the Accelator the modern streamlined water treating process?

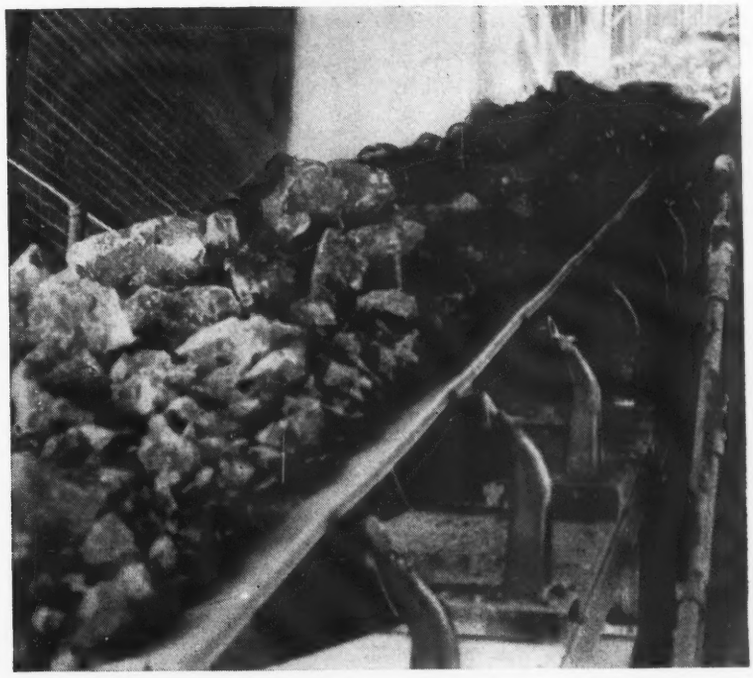
HOW does the Accelator process accomplish such remarkable results in such small space?

WHY has the Accelator so many exclusive advantages in clarifying, softening or stabilizing waters of widely varying qualities?

For the answers . . . send for Bulletin 1824

INFILCO

ACCELATOR SOFTENERS • CATEXERS • CLARIFIERS
PROPORTIONERS • CHEMICAL FEEDERS • CONDENSATE FILTERS
COOLING WATER CONDITIONERS • STEAM PURIFIERS • WATER FILTERS
HOT-FLOW SOFTENERS • LIME-SODA SOFTENERS • ZEOLITE SOFTENERS



TAKE *Extra* CARE of your CONVEYORS

EVERY PART of your materials handling equipment is made of critical materials . . . the metal in the idlers . . . the rubber and duck in the belting . . . even the bearings which enable the equipment to run smoothly and move quickly. So take *extra* care of your Conveyors.

See that all the idlers are in good operating condition . . . that they are lubricated properly and adequately. When lubricating Robins Idlers (which can be done from either side, due to patented design) it is easy to tell when enough grease has been added; it begins to escape through the far-side fitting.

See that the belt runs true; a crooked-running belt may cause not only spillage but also excessive wear. If your belting has a tendency towards side-sway, Robins Training Idlers will keep it straight in both carrying and return strands.

Where very heavy and lumpy material is handled, the excessive belt wear or actual damage imposed at loading points can be greatly reduced by installing Robins Rubberdisc Cushion Troughing Idlers . . . giving you longer belt-life.

Examine your conveyors critically. See whether you are doing justice to them, to yourself and to the conservation program by assuring that they are in condition to render maximum service in these times when maximum production is so vital.

If you need assistance or advice on the proper care of materials handling equipment, ask Robins engineers. Their knowledge is at your disposal wholly without obligation.

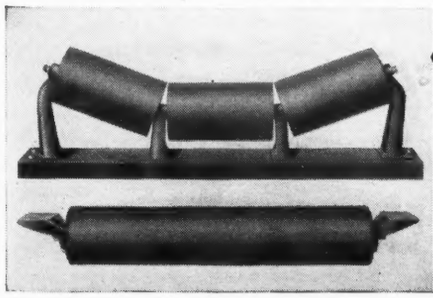
ROBINS

CONVEYING BELT COMPANY

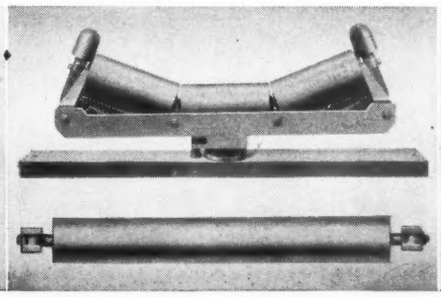
PASSAIC • N. J.

For Material Aid in Materials Handling . . . *It's ROBINS*

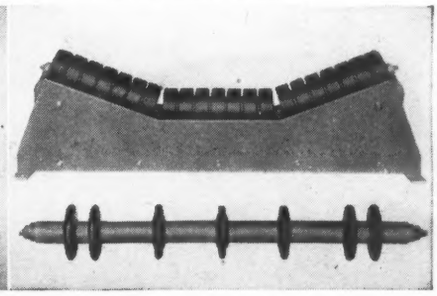
Robins Roller Bearing Troughing Idlers are Timken equipped for smooth running. Made in steel and in one-piece cast-iron.



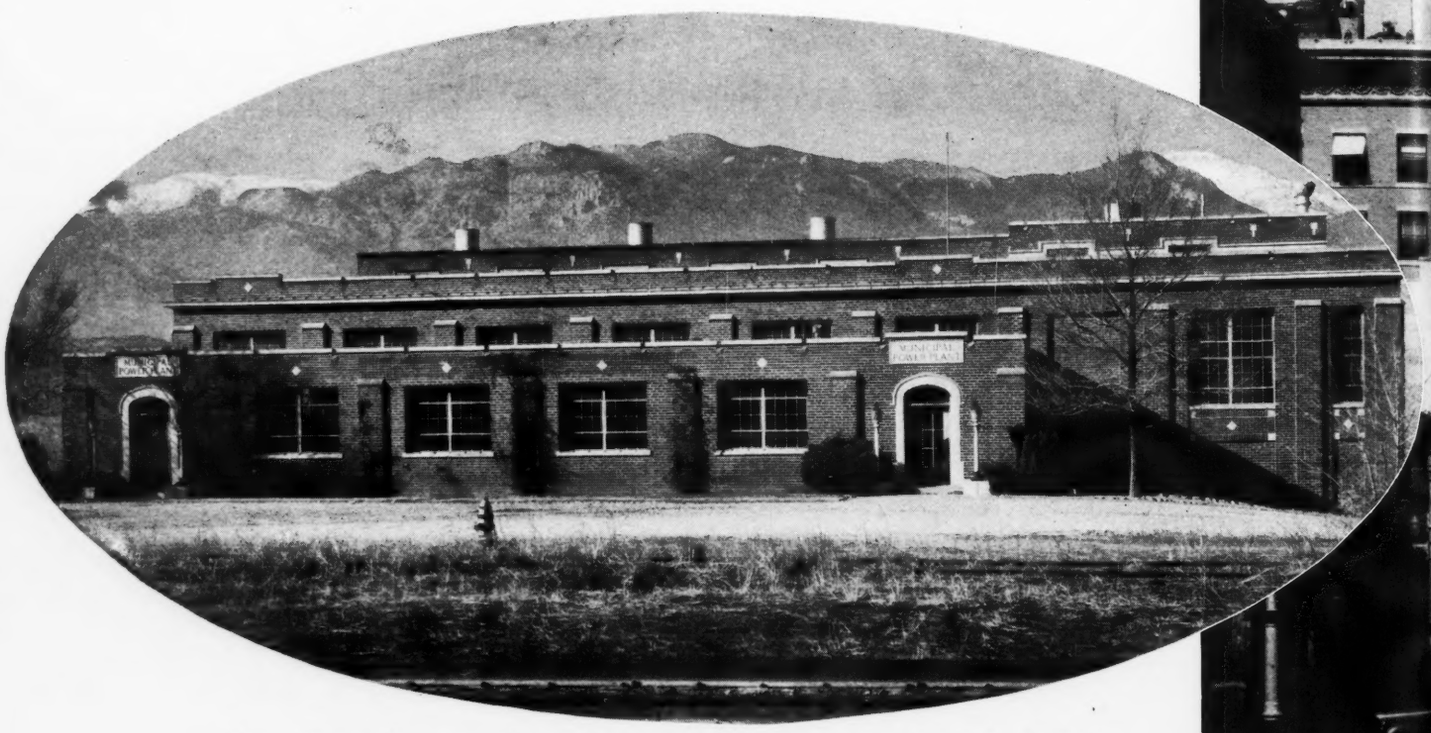
Robins Training Idlers prevent crooked running belts in both carrying and return strands.



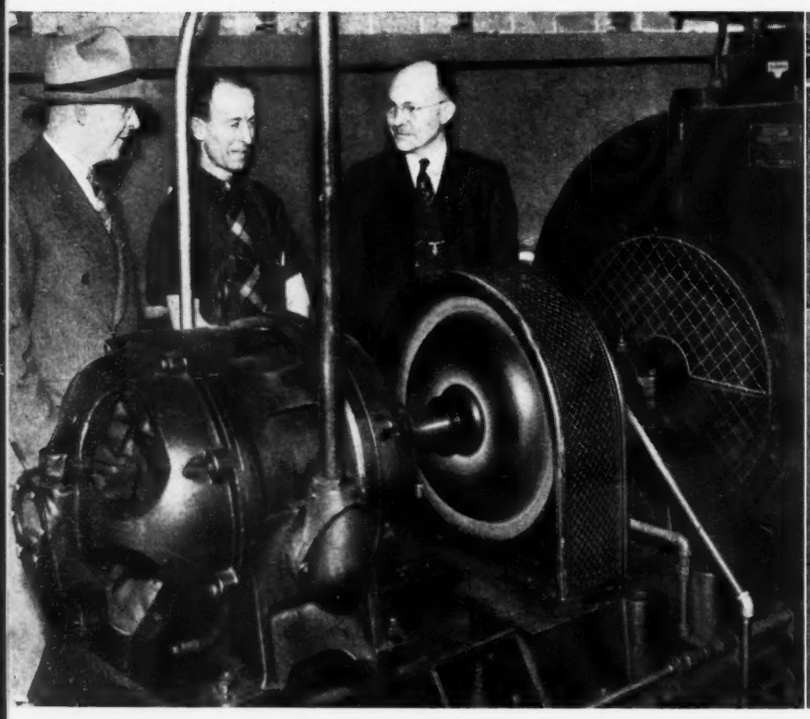
Robins Rubberdisc Cushion Troughing Idlers (Timken equipped) absorb shock at conveyor loading points.



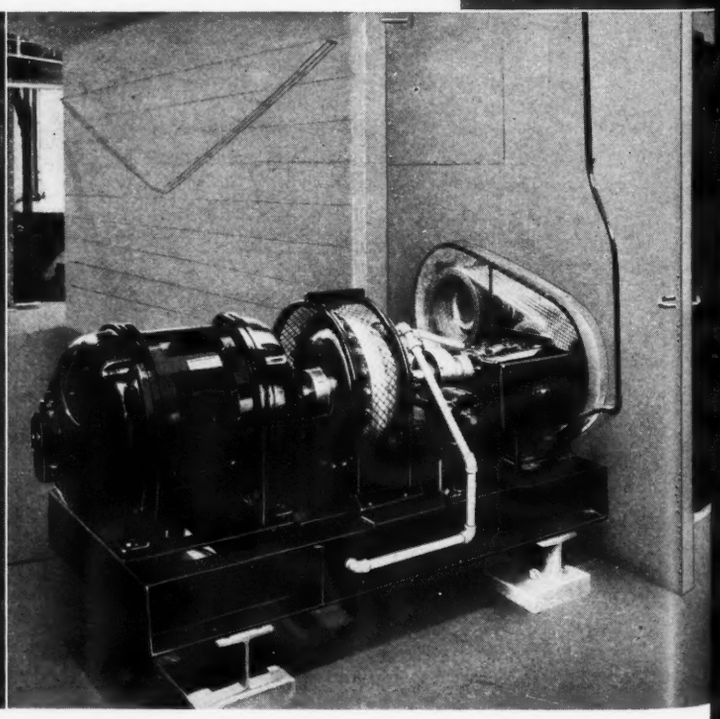
COLORADO SPRINGS



Above—The modern generating station that supplies electric power for Colorado Springs, Colorado. At right—View in downtown Colorado Springs, with Pike's Peak in background.

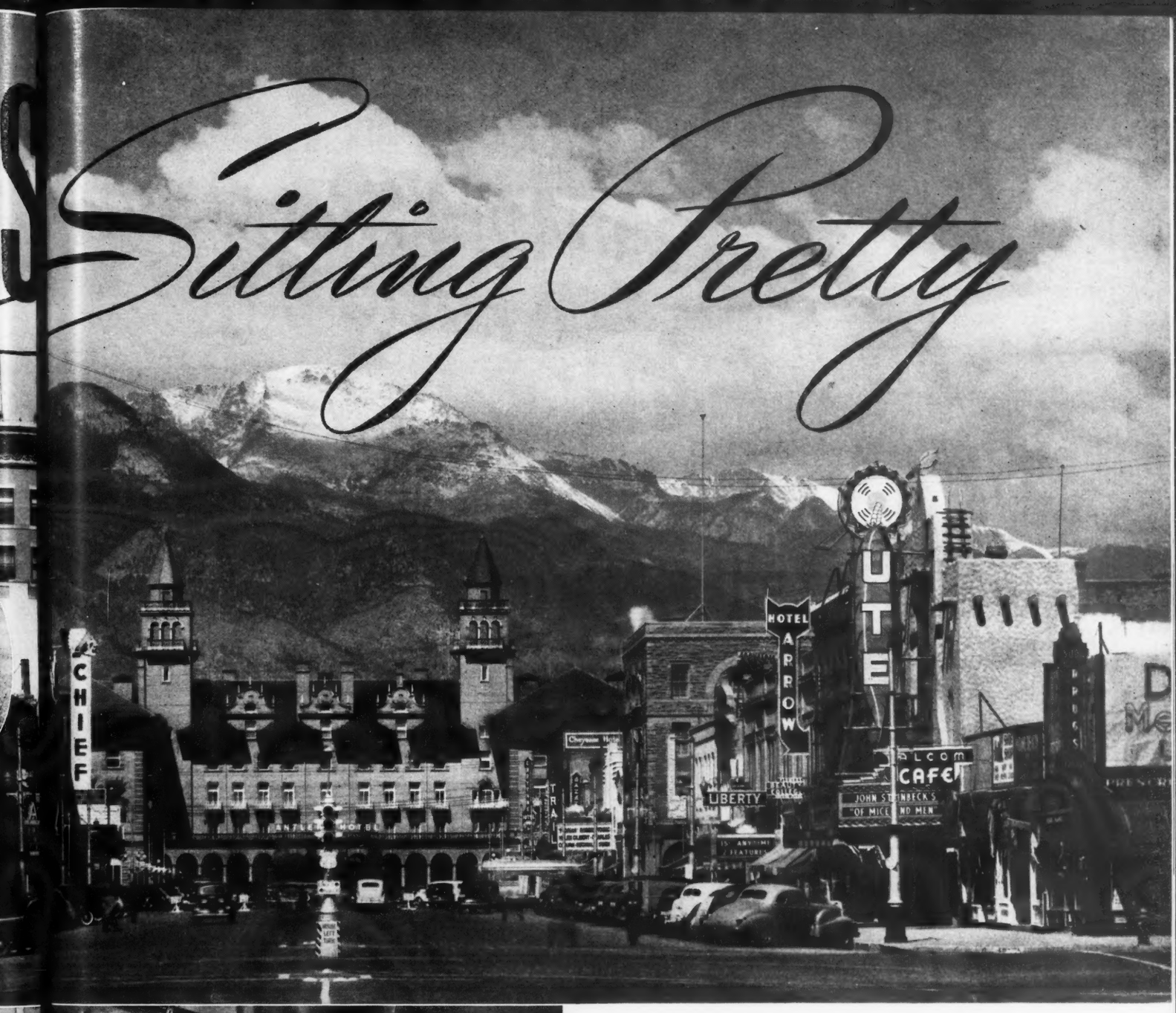


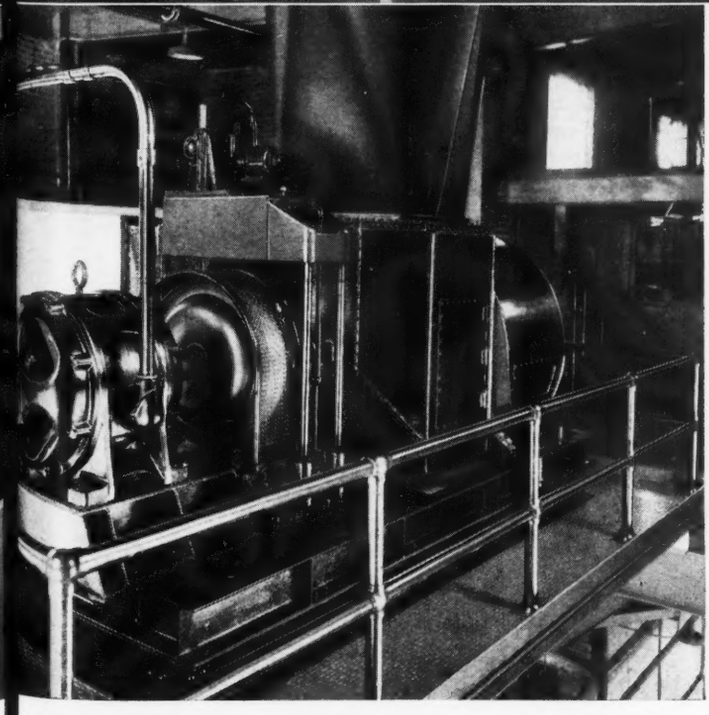
AMERICAN BLOWER Forced Draft Fan driven through an American Blower Fluid Drive (Hydraulic Coupling) in the electric generating station shown above.



THIS V-BELT DRIVE arrangement of an American Blower Forced Draft Fan driven through an American Blower Fluid Drive was pioneered in Colorado Springs.

Sitting Pretty





AMERICAN BLOWER Induced Draft Fan, driven through an American Blower Fluid Drive. Write to the nearest American Blower branch office for complete data.

Colorado Springs, famous health and pleasure resort, financial center and market for the Cripple Creek gold field, important distributing point for Colorado mined coal, has been "sitting pretty" for a long time. A "young" city, incorporated in 1872, Colorado Springs was quick to utilize the modern aids to civic progress . . . by no means least among these, electric generating facilities capable of supplying abundant, dependable, electric power to meet all the needs of the community. American Blower Forced and Induced Draft Fans are functioning in the modern plant that supplies this power. And the plant is 100% American Blower Fluid Drive (Hydraulic Coupling) equipped — a fact that makes us doubly proud!

MECH. DRAFT · AIR-CONDITIONING
AMERICAN BLOWER
FLUID DRIVES · DUST COLLECTORS

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator and Standard Sanitary Corporation

SURFACE CONDENSERS
FEED WATER HEATERS
EVAPORATORS EJECTORS

BY

LUMMUS

As a leading designer and builder of complete refineries, Lummus was for years the largest single purchaser of heat transfer equipment. In a 40,000 barrel per day refinery, for example, heat exchangers, lube oil coolers, etc., will amount to more than half a million dollars.

With a view to securing heat exchangers and similar equipment of improved design, made to even higher standards of precision and workmanship, Lummus decided to make — and for four years has been producing — heat exchange equipment for the plants it designed and built.

Recent expansion of the Lummus heat exchanger plant at Honesdale, Pennsylvania, makes available a limited capacity for surface condensers, feed water heaters, evaporators, ejectors and similar equipment for the public utility and power fields. In addition to improved design and new standards of precision, public utilities and power plants are offered the services of Lummus engineering personnel for the study of specific problems and the design and construction of Lummus-built equipment to meet definite conditions. Requests for further information will receive prompt attention.

THE LUMMUS COMPANY · 420 LEXINGTON AVE., NEW YORK, N. Y.

LUMMUS

Five Good Reasons Why

SHAW PREFABRICATED PIPING *is* DEPENDABLE ACCURATE ECONOMICAL

EQUIPMENT — Shaw's skilled specialists work under the most favorable shop conditions with the best equipment.

ORGANIZATION — The Shaw Company maintains a large corps of capable engineers and skilled workers, long experienced in piping prefabrication and installation.

EXPERIENCE — Since 1893, Benjamin F. Shaw Company has specialized in the prefabrication and installation of piping for power and industrial plants.

PERFORMANCE — The record of the Shaw Company in the prefabrication and installation of piping for important jobs all over the country speaks for itself. We invite your inquiry.

RESEARCH — Continuous piping research in improving its performance characterizes Shaw's work.

Benj. F. Shaw II
President

BENJ. F. SHAW COMPANY

2nd & Lombard Streets, Wilmington, Delaware

PIPING FABRICATORS, CONTRACTORS AND DISTRIBUTORS

COTTRELL PROCESS

of

ELECTRICAL PRECIPITATION

universally recognized as a
standard method of removing

DUST, FLY ASH, FUME, MIST & FOG

***from* GASES**

•

30 years of research development and operating experience by the affiliated Cottrell Companies throughout the world is incorporated in the

COTTRELL INSTALLATIONS

offered to meet the requirements
of any problem by

RESEARCH CORPORATION

405 LEXINGTON AVENUE
NEW YORK CITY

59 EAST VAN BUREN STREET
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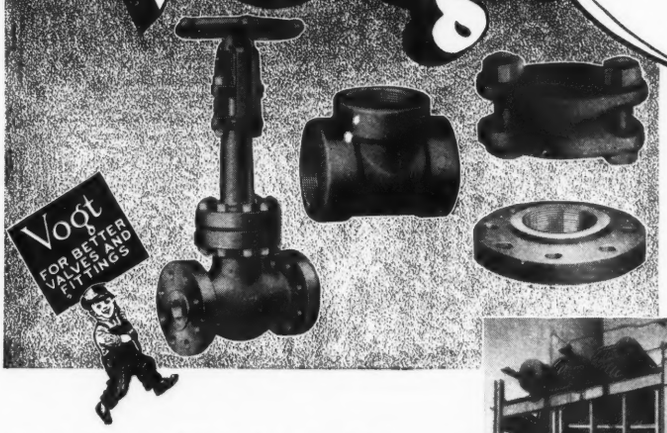
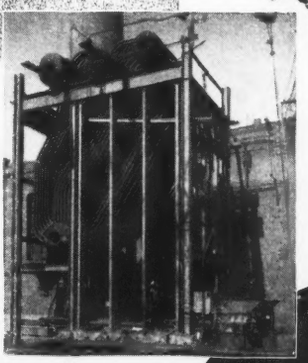
Vogt PRODUCTS ARE

★ DESIGNED to RAISE
★ OPERATING STANDARDS and
★ LOWER YOUR COSTS



Drop Forged for Safety and Economy under the Most Trying Conditions

Valves, Fittings and Flanges by Vogt—the choice of operating men everywhere for safe and sure regulation of the high pressure and high temperature liquids and gases used in modern process work.



High Operating Efficiencies and Low Maintenance Costs

More steam per dollar of investment—because Vogt steam generating equipment is designed and built to fit in with specific operating conditions. Vogt boilers are available in bent tube types and straight tube, forged steel sectional header types for solid, liquid, or gaseous fuels, as desired. Three-drum types can be supplied to fit any conditions of restricted installation space.

Meeting the Demands for Operating Security

Vogt has every facility for the fabrication of stills, towers, continuous rotary filters, filter presses, oil chilling machines, heat exchangers, etc., and these products are serving the petroleum industry around the world.

Vogt PRODUCTS

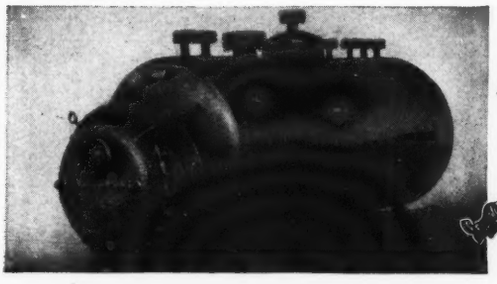
For Oil Refineries, Chemical Plants, Power Plants and Related Industries

☆

HENRY VOGT MACHINE CO.

LOUISVILLE, KENTUCKY

NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • DALLAS

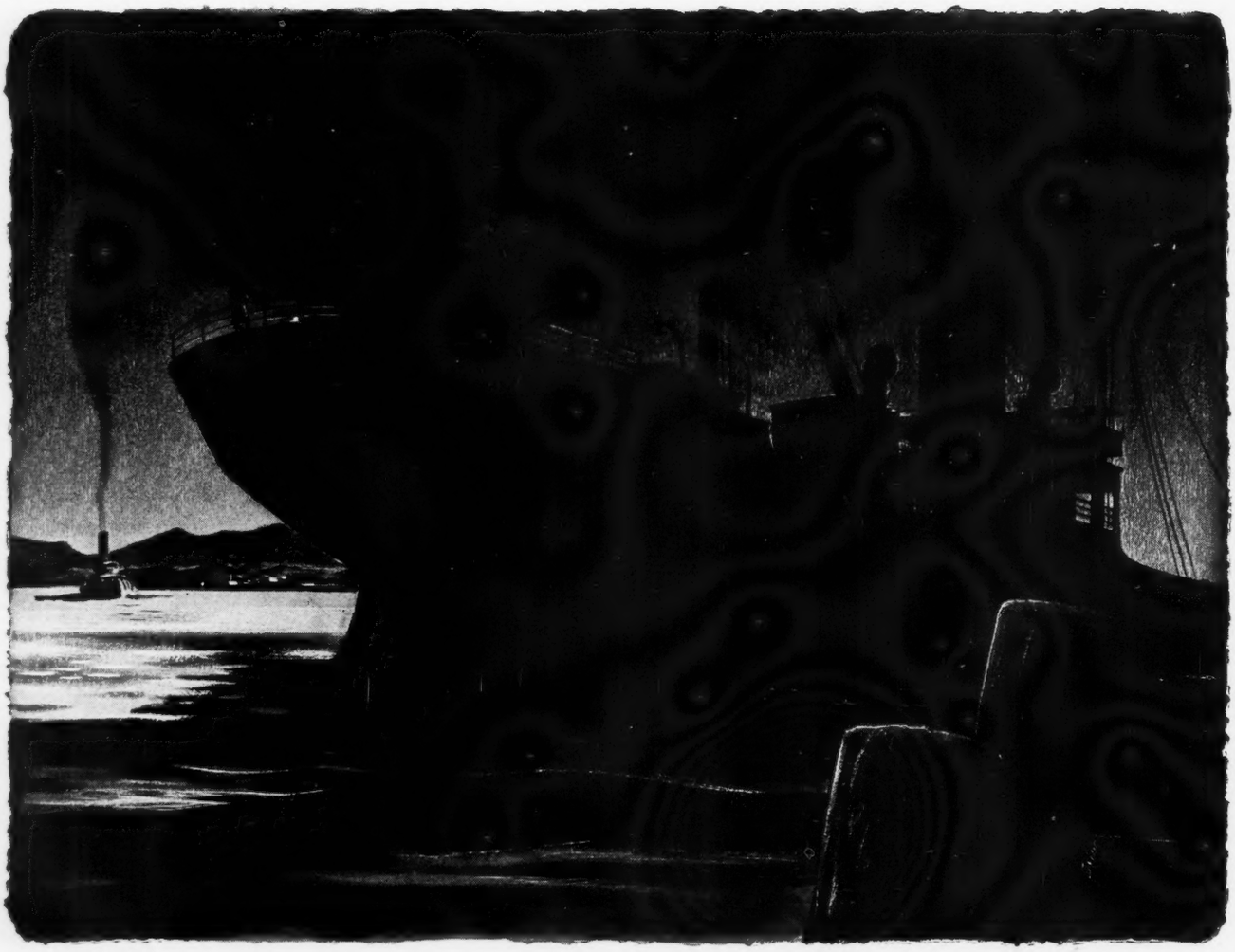


To Combat Corrosion and Product Contamination

Process equipment made from special metals and alloys for the exacting service of the chemical plant is fabricated in our modern shops for many of the well known chemical companies.

Steps Tonnage Up and Costs Down

Our experience of more than 50 years in building profit-making ice and refrigerating machinery is at your command. We make complete units for ice and cold storage plants, packing plants, dairies, breweries, chemical plants, oil refineries, etc.



There go your Valves!

Honor to you men who wait so that America and her ships can have valves some of you need so desperately.

★ ★ ★

"TO AMERICAN SHIPS! MAY GREAT FLEETS OF THEM SAIL FORTH—TO RETURN, SOON, WITH PEACE."

We can drink that toast together for we sweat with you. Scarcely had READING-PRATT & CADY completed tremendous additions to capacity—to meet the greater demands you were making for READING-PRATT & CADY VALVES—than came Pearl Harbor. Immediately following, we heard the call for more ships than the world had dreamed possible to build. Every ship is a maze of valves. And we were asked to take the responsibility for many of them.

Round-the-clock production was put in force at once. But your deliveries have been and are delayed—longer than we hoped for—and the problem is complicated by certain shortages. We believe that many of you see that this is the only road to travel today—that when you hear of fleets of American ships carrying their precious cargos to far corners of the world, you get no small measure of satisfaction from realizing that valves you might have had, helped do the job.

READING-PRATT & CADY

MANUFACTURERS OF R AND P&C CO. VALVES AND FITTINGS

Reading, Pa., Atlanta, Boston, Chicago, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco

A DIVISION OF ACCO AMERICAN CHAIN & CABLE COMPANY, INC., BRIDGEPORT, CONNECTICUT

HOW COAL IS MOBILIZED

he above transfer point a compact S-A Redler Conveyor returns surplus coal from sampler to the main conveyor system.

by S-A Conveyor Units

Coal is *stored power.* But time and power are often wasted getting coal to the point of conversion. It is companies which see this who buy S-A Conveyor Units.

The impressive layout above is designed to handle coal in great volume with minimum effort and utmost accessibility. From the receiving hopper the S-A Belt Conveyor elevates the coal to a transfer point. From here it goes on to the power plant bunker, or can be diverted via the projecting boom conveyor to outdoor surplus storage. This is reclaimed as needed by other S-A Belt Conveyors in a tunnel beneath the pile.

It is for such complete, well-planned jobs by company engineers that the big S-A Catalog of Conveyors, Elevators, Screens and Transmission Equipment offers complete data. Catalog No. 55 is available to Engineers on war projects who write on company letterhead, giving title and complete address.

STEPHEN S-A DAMSON MFG. CO.

Chains and Sprockets
Bin Gates
Speed Reducers

Belt Conveyors
Pan Conveyors
Redler Conveyors

SealMaster Ball Bearings

Bucket Elevators
Feeders
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Crushers
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Winches and Car Pullers

5 Ridgeway Avenue, Aurora, Illinois

WeldELLS

It's the difference between RIGHT and WRONG —*this "selective" reinforcement*

BOTH mathematical calculations and practical tests* prove that the bursting stresses in an elbow are greatest at the crotch or inner wall. That's why a special process is employed in producing WeldELLS which provides extra metal in this region of greatest stress as pointed out above. It is the nearest possible approach to the "One Hoss Shay" ideal of absolutely uniform strength throughout.

And it's also one more example of the length to which we have gone in producing WeldELLS to follow sound engineering considerations—considerations which mark the difference between right and nearly right.

An extra value, this—and opposite are listed other extra-value features that are combined in no other fittings for pipe welding. Yet: WeldELLS cost no more!

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P. O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.

WeldELLS *have everything—*

No other fittings for pipe welding combine the features found in WeldELL. In addition to that described, they include:

▶ **Seamless**—greater strength and uniformity.

▶ **Tangents**—keep weld away from zone of highest stress—simplify lining up.

▶ **Precision quarter-marked end**—simplify layout and help insure accuracy.

▶ **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.

▶ **Wall thickness never less than specification minimum**—assures full strength and long life.

▶ **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.

▶ **The most complete line of Welding Fittings and Forged Steel Flanges in the world**—insures complete service and undivided responsibility.

* The amount by which stress is greater at the crotch in a fitting having uniform wall thickness depends only on its radius. Mathematical analysis (specifically the Lorenz formula) shows the stress at the crotch to be:

$$S = \frac{pr\,(2R - r)}{2t\,(R - r)}$$

Where S = Bursting stress, lbs. per sq. in.
p = Internal pressure, lbs. per sq. in.
r = ½ inside diameter of fitting (O.D. if Barlow's formula is desired).
t = Wall thickness in inches.
R = Center line radius of fitting, inches.

Numerous tests by the Research Division of Taylor Forge show the formula given above to be somewhat on the conservative side.

TAKE a good look at this gloating scoundrel . . . our evil enemy . . . the Axis. He's smirking, but one quick way to wipe that grin from his face is by conserving the tools we use, for conservation is important to production. The Exide Batteries you use for Diesel-cranking are long-lived, dependable, and deliver high voltage quickly. But make them last longer and you're hitting the Axis. Follow these four simple rules and *Save to Win!*

Exide
BATTERIES
FOR CRANKING DIESEL ENGINES

MAKING BATTERIES LAST HELPS STOP THE AXIS!

1. Keep adding approved water at regular intervals. Most local water is safe. Ask us if yours is safe.
2. Keep the top of the battery and battery container clean and dry at all times. This will assure maximum protection of the inner parts.
3. Keep the battery fully charged—but avoid excessive over-charge. A storage battery will last longer when charged at its proper voltage.
4. Record water additions, voltage, and gravity readings. Don't trust your memory. Write down a complete record of your battery's life history. Compare readings.

If you wish more detailed information, or have a special battery problem, don't hesitate to write to Exide. We want you to get the long-life built into every Exide Battery. Ask for booklet Form 2399.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

for defense against losses . . .

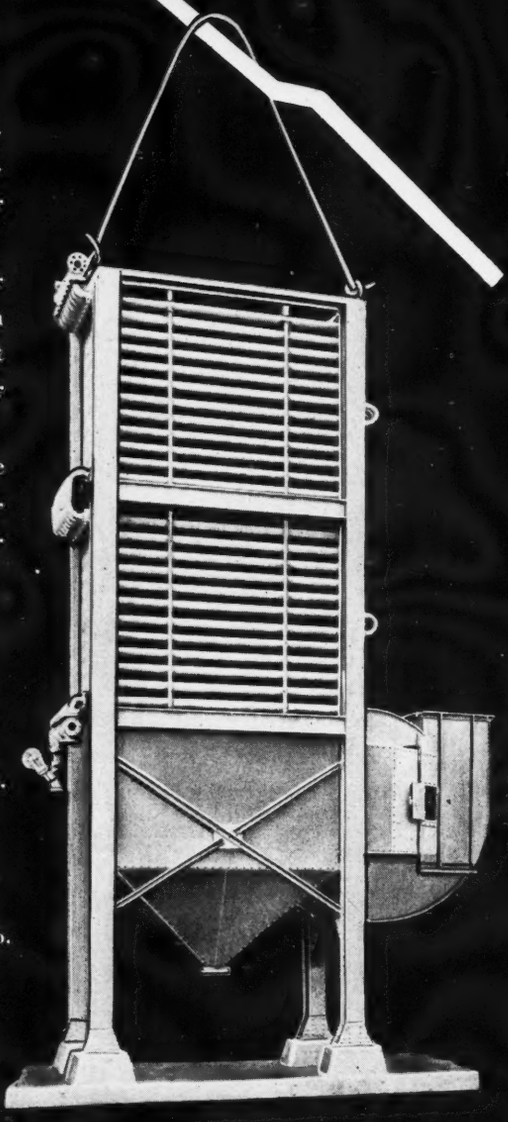
hang this economizer on your steam-cost curve

If your power plant dates back to the early twenties—if you are not using good heat recovery equipment—if you are pushing that plant twelve to twenty-four hours a day, we can pull your steam costs down.

The savings are, of course, dependent on your operating conditions. Basically, the installation of a Green Fuel Economizer will result in a one per cent fuel saving for every ten degrees rise in feed water temperature.

Service reports show that the savings effected the first year often exceed the first cost of this equipment—and then pay a substantial dividend throughout years of service.

Why not consult Green—*now*?



Green Cast Iron Fuel Economizers are manufactured in all sizes for pressures up to 450 pounds per square inch.

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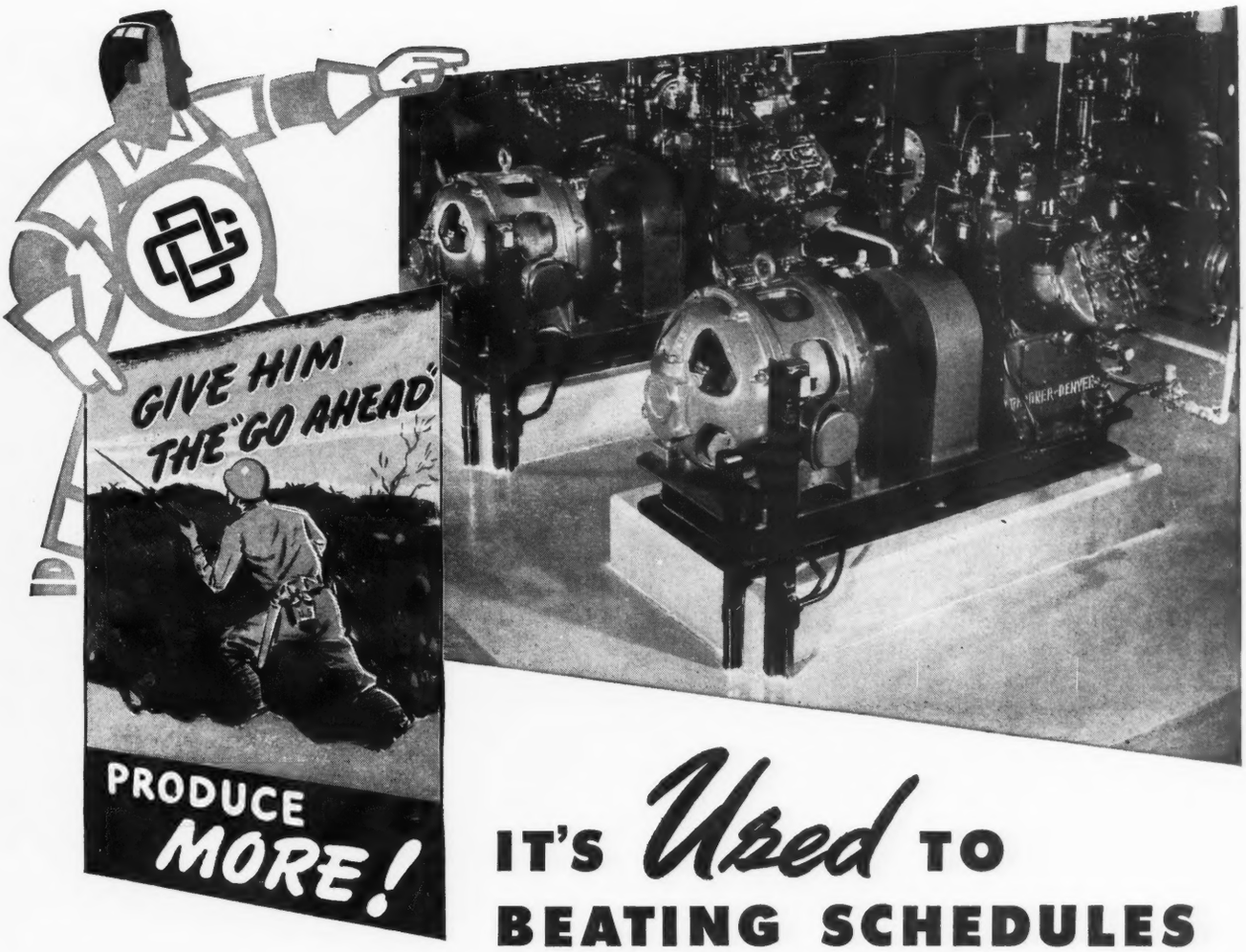
THE GREEN *Fuel Economizer* COMPANY INC.
BEACON NEW YORK

MECHANICAL DRAFT FANS · AIR PREHEATERS · ECONOMIZERS · CINDERTRAPS



IT'S *Used* TO BEATING SCHEDULES

Fortunate are those war plants that enjoy the *extras* of a Gardner-Denver "WB" Two-Stage Vertical Air Compressor. For here's a compressor compact in size—efficient in operation—that is *used* to the job of beating schedules by providing more air—economical air—dependable air.

Gardner-Denver engineering skill, combined with years of experience in manufacturing quality compressors, make the Gardner-Denver "WB" an unusually compact, highly efficient machine.

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4. Castings of GarDurloy give extra strength and hardness where needed.
5. Built in sizes ranging from 142 to 445 cubic feet displacement per minute.

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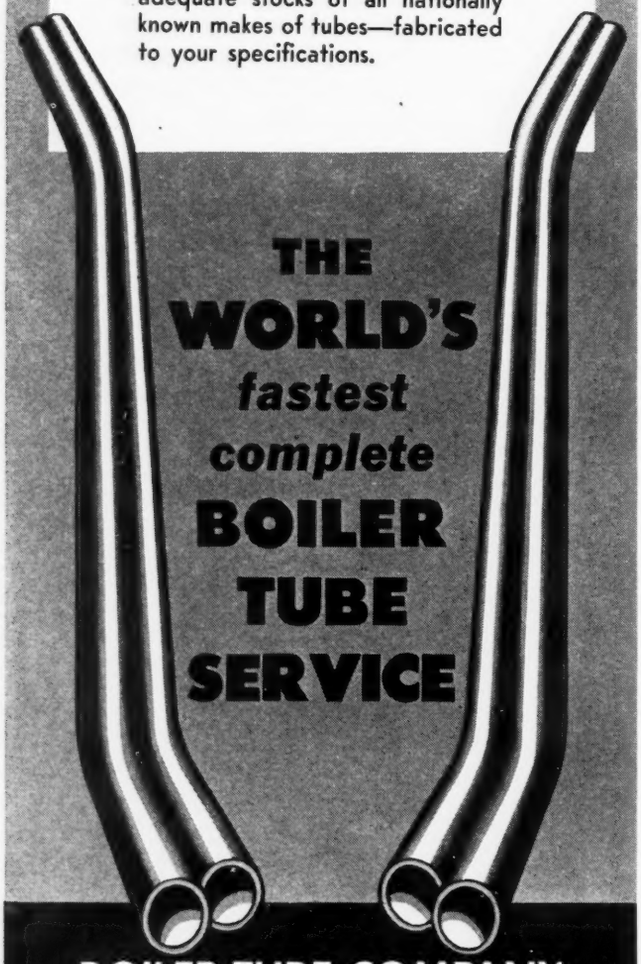

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PIPEWRENCH PETE SAYS:

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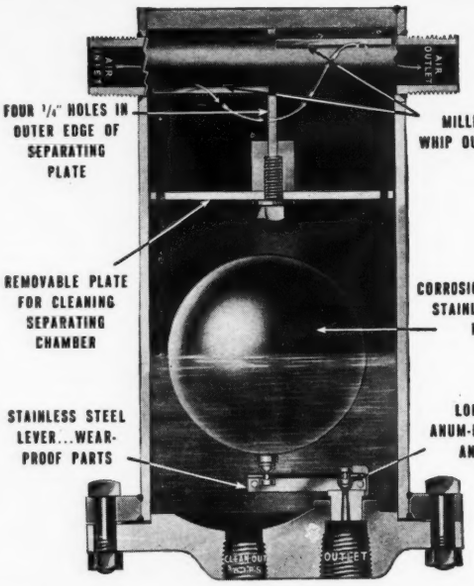
STRONG COMBINED SEPARATOR AND TRAP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THE De Laval Oil Purifier keeps lubricating oil clean—continuously and unfailingly. Thus, it enables oil to provide a maximum of protection to moving parts. At the same time, it enables the oil to be *safely* used over long periods.

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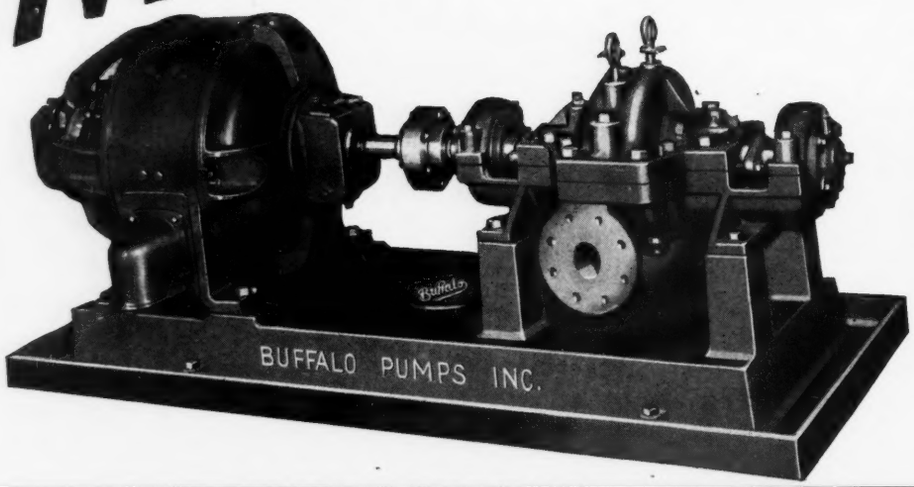

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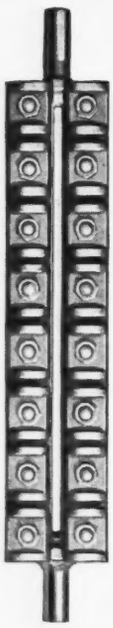

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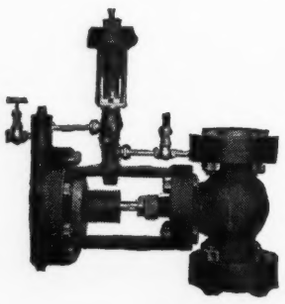

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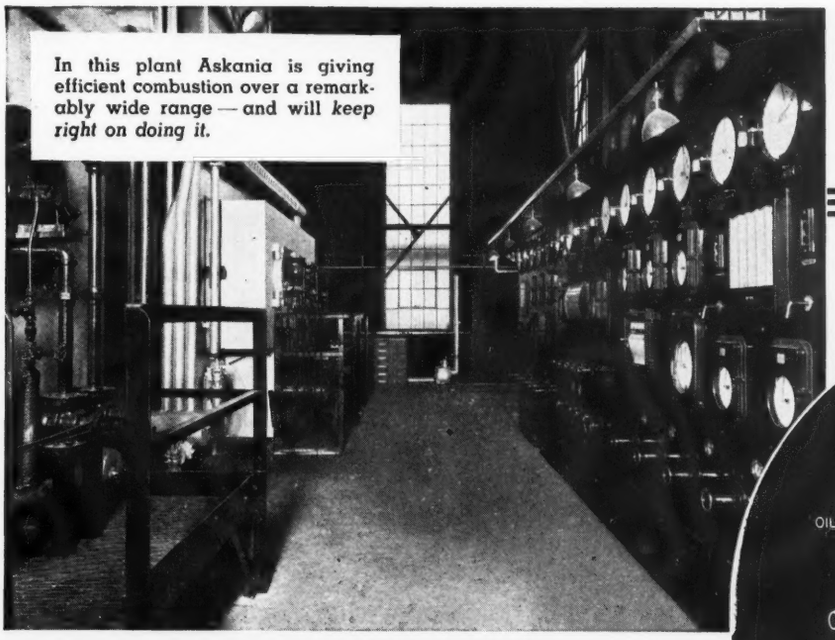
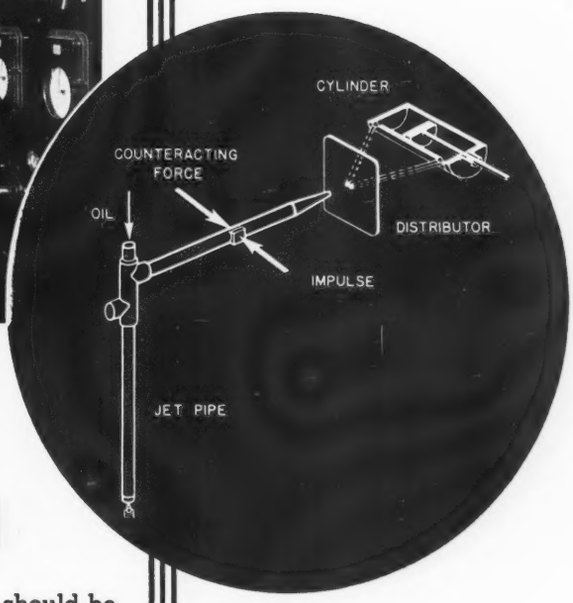


In this plant Askania is giving efficient combustion over a remarkably wide range — and will *keep right on doing it.*



More than ever — you need this trouble-free control

IN the battle of production, the equipment in the front line should be judged as a soldier is judged—not by the way it starts, but by the way it *keeps going!*

Shut-downs for adjustments mean serious production loss now that boiler capacity is taxed to the limit. Tinkering with equipment that is supposed to be automatic diverts skilled men from jobs that are vital to defense. So today that distinguishing characteristic of Askania Combustion Control—its ability to do its job right day after day and year after year—means even more than ever before.

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● Observe this principle carefully —for it is the secret of greater sensitivity of control with greater dependability and lower maintenance than can be achieved in any other way.

It consists of the jet pipe which swings on a hollow pivot into which oil is pumped. As the oil issues from the nozzle it strikes at two closely adjacent orifices in a distributor plate which are piped to each side of the double-acting piston which adjusts the valves, dampers, etc. The slightest variation in the "impulse" moves the jet pipe, causing the oil pressure to increase or reduce in either the right or left orifice, thus moving the piston to correct for the variation in the "impulse."

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. . . engines as drives for auxiliary equipment

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THEY have a pretty good power cost record—these engines and sets. The average cost in many surveyed plants is only ½ cent per kw.h. It's a record that hardly can be ignored.

The Troy-Engberg Steam Engine is being used for driving all kinds of auxiliary equipment, such as: stokers, fans, blowers, pumps, compressors, cookers, dryers, etc. In small plants, it also is used for driving equipment but often is shipped with an AC or DC generator in the form of a Generating Set to provide the only current for light and power. Troy-Engberg Sets are also used in large plants for stand-by power; for week-end, night and holiday load, or for reducing demand charges.

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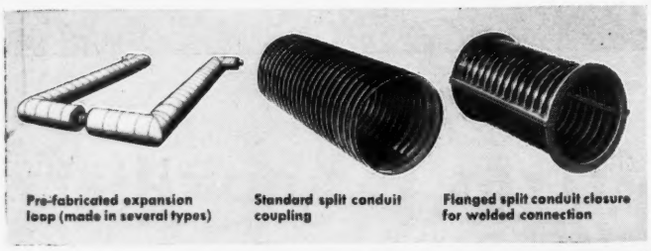
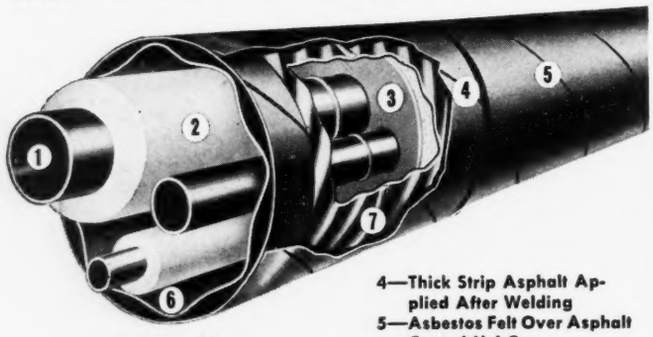


Pre-fabricated expansion loop (made in several types) | Standard split conduit coupling | Flanged split conduit closure for welded connection



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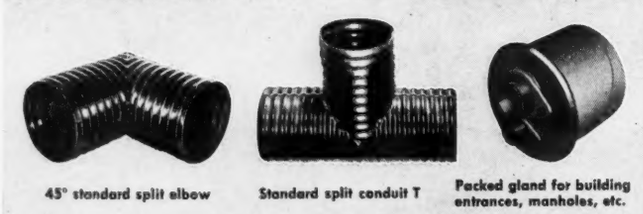

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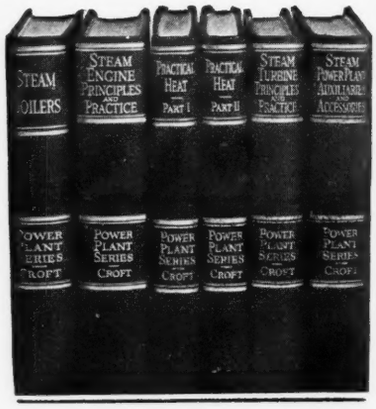
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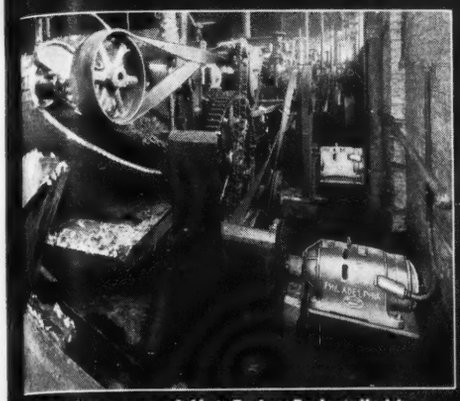
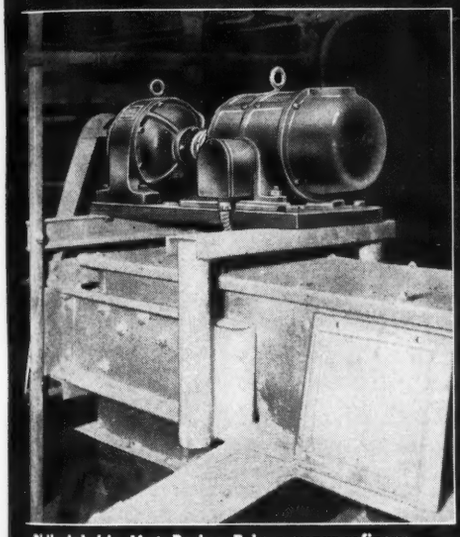


Two of a group of MotoReduceRs installed in a wool scouring plant



Philadelphia MotoReduceR in a sugar refinery

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1170	155	20
950	125	16.5
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640	84	11.0
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420	56	7.5
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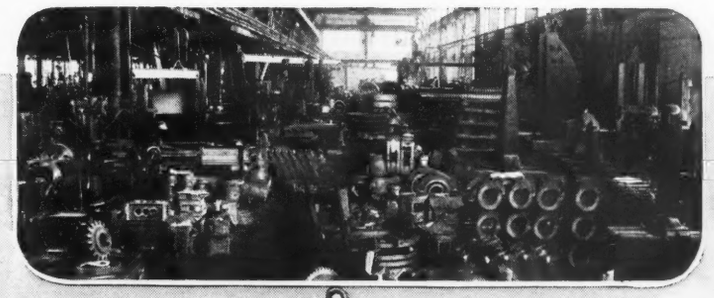

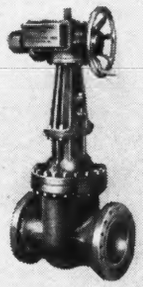

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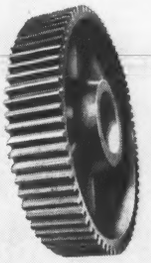

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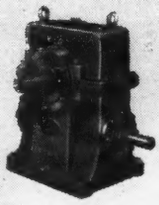

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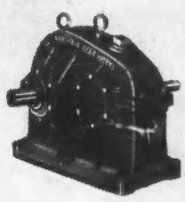

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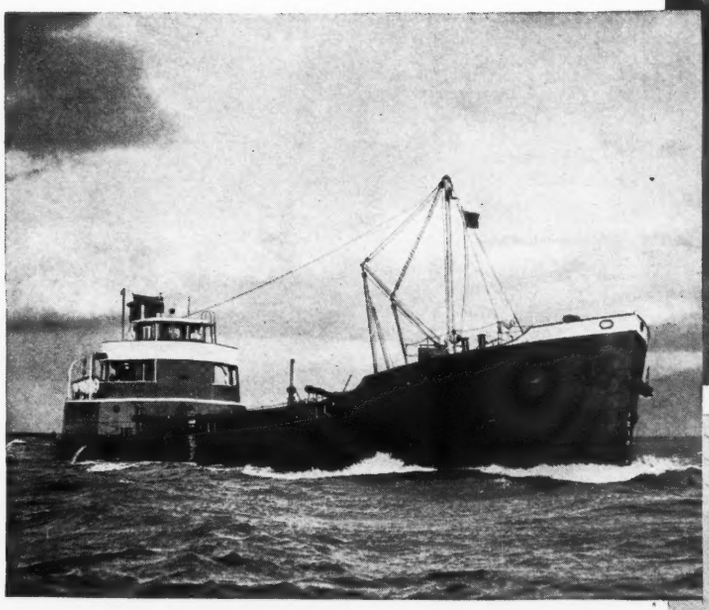

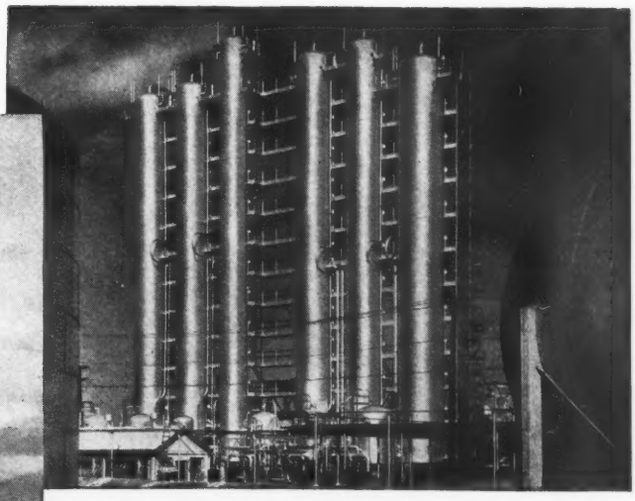

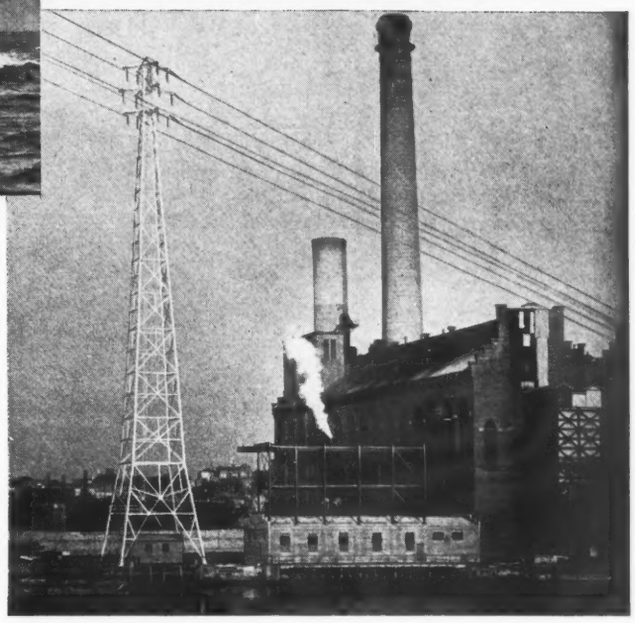

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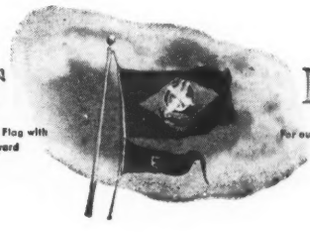

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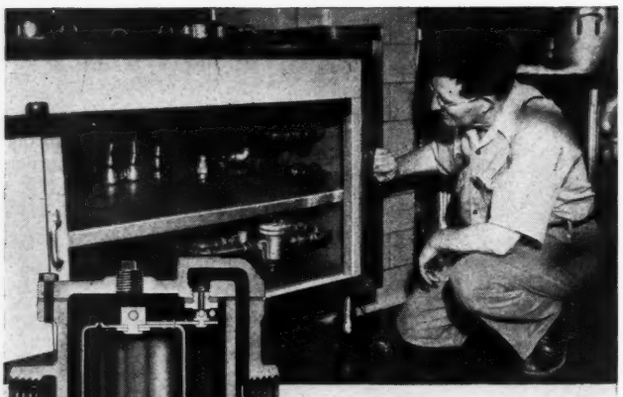

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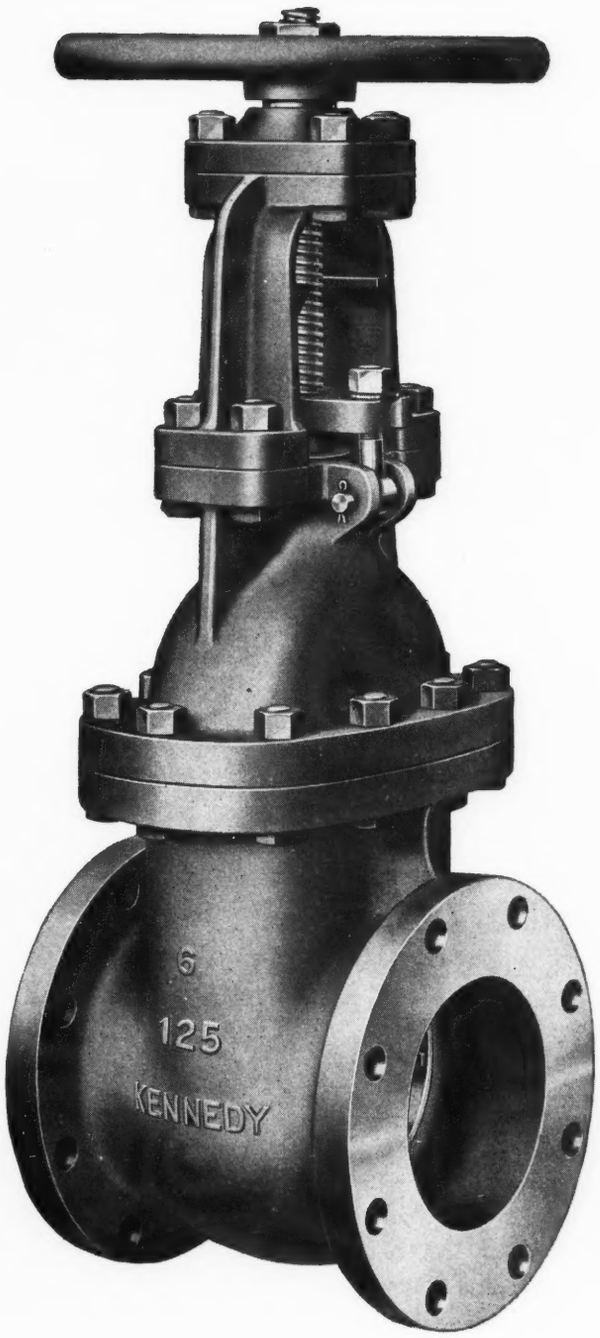

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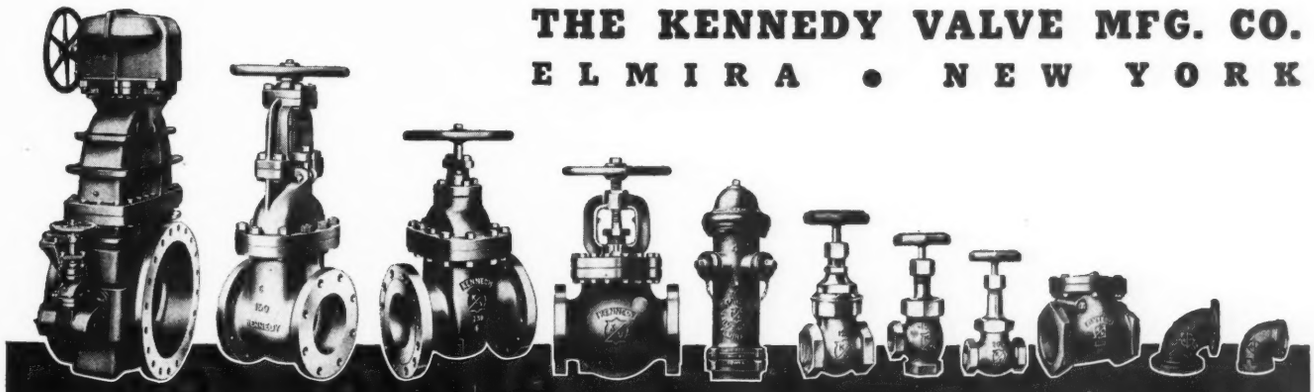

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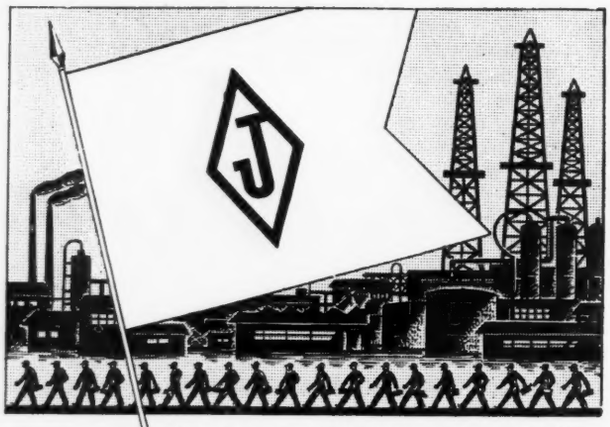

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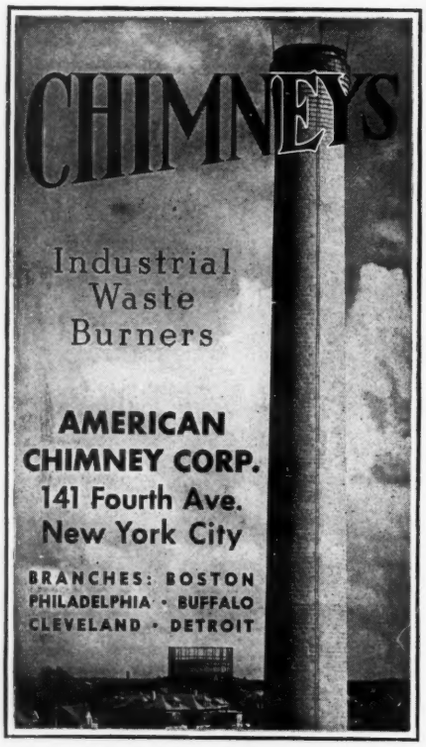

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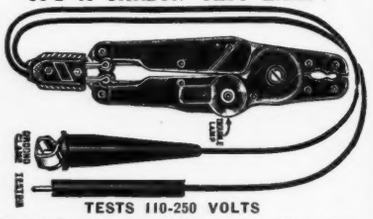

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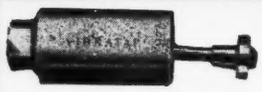

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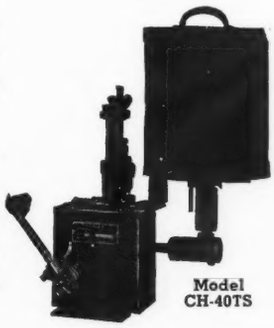

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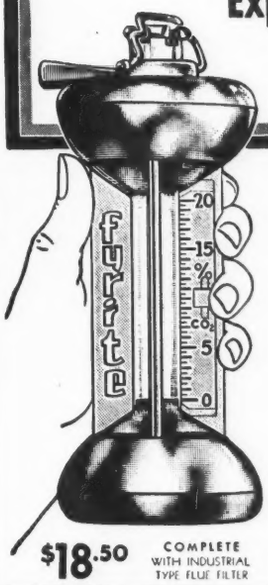

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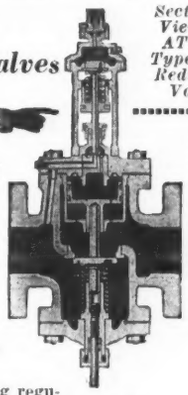
ATLAS *Reducing Valves* TYPE "A"

Sectional View of ATLAS Type "A" Reducing Valve



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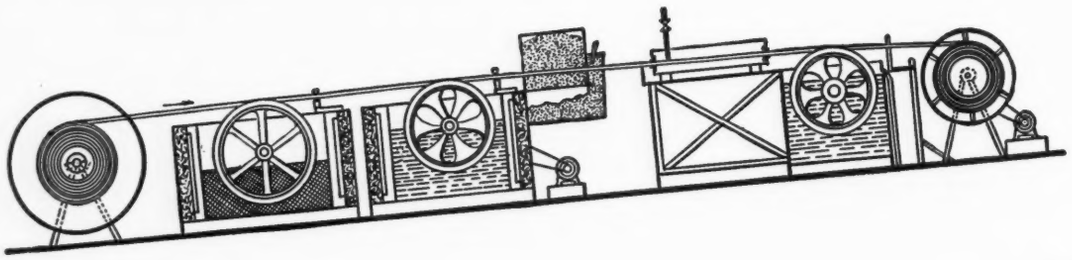
is engineered scrap



This war machine was built from an old pulley, the rear wheels of a truck and odds and ends of sheet steel.

It will never fire a projectile nor drop a bomb. But if our enemies really understood America it would frighten them.

The function of this scrappy gadget is to renew the weather-proofing on electric power wire . . . wire that would otherwise have to be junked.

▶ But war teaches us to look beyond machines to the hearts and minds of the men who make them.

In such perspective the device shown above takes on deep significance. It becomes a mechanical parable on the ingenuity of men whose job it is to keep electric power flowing to the vital war industries, regardless of shortages of copper, steel, rubber, aluminum.

▶ There are hundreds of such parables in every war-converted industry. Here are just a few from our great electric power plants:

. . . tons of bolts are being saved by a new method of rigging crossarms on electric poles.

. . . a southern generating station found its dam weakening. To keep the power flowing, holes were bored through the concrete and the dam bolted to bedrock!

. . . to avoid a shutdown, a middle-Atlantic utility worked out a method of stopping leaks around the giant valves controlling its water supply by mixing *sawdust* with the water. It worked.

. . . a western company bought old suspension cables from the wrecked Tacoma Bridge, untwisted them and used the metal as concrete reinforcement.

So goes the saga of electric power, as the industry does its share in the common task . . . With much of its trained man-power in the services, with priorities available only in the most urgent cases, the American utilities are showing the stuff American management and labor are made of.

But where are the stories of plants rushed into being almost overnight to supply electric energy?

As an American, you can thank your lucky stars such stories are few. Generating plants and power lines take years to build. For instance, our country's power equipment at the start of the war represented an investment of more than the present combined cost of the two-ocean navy and lend-lease expenditures.

War conversion for this vigorous industry was almost as simple as pushing the light switch on your reading lamp. The power was there because energetic managements had created it in the normal course of American life.

Some rush construction was necessary, but the electric power industry was first in war *because* it had been first in peace.

▶ The story goes back to the depression years. The utilities were the first to shake off the doldrums. By 1935, they had already passed 1929 levels.

. . . By the time the war broke out in Europe, America's giant electrical capacity surpassed that of any combination of potential enemies.

. . . It has grown since then, with 3½ million kw. capacity scheduled to be added in 1942. This year, the industry also will spend 150 million dollars on maintenance alone.

▶ Because of these private expenditures, because the electrical companies started years ago to sell women on the convenience of electrical home appliances . . . and because the industry has always built in advance of demand, it was ready for either peace or war, with the world's greatest system of power production and distribution.

★ ★ ★

In recognition of the miracle of war production—accomplished through the cooperation of American management and labor with the W. P. B. . . . this advertisement is published by the McGraw-Hill Network of Industrial Communication.

McGRAW-HILL PUBLISHING COMPANY, Inc.

330 WEST 42nd STREET • NEW YORK

WITH A POSTSCRIPT FOR BUSINESS EXECUTIVES

PERHAPS you saw the advertisement on the opposite page, in the newspapers.

Did you notice those five examples of the way in which maintenance men are meeting the problem of war operation?

That's what this page is about.

If one public utility maintenance man works out a new way of reconditioning wire, his idea becomes really valuable to the country when all maintenance men with a similar problem find out how he did it.

If one man experiments with silver and bismuth as a substitute for tin solder, that becomes great news for a man who needs tin solder and can't get it.

That's why industry after industry has been able to meet the war production challenge . . . by swapping ideas.

▶ In industry, this idea swapping is done mostly through the editorial and advertising pages of the industrial press.

McGraw-Hill, for instance, keeps 153 editors and 725 engineer-correspondents busy digging up new methods of doing things.

Industrial advertisers, too, often send men into the field to discover new ways of making their products do more work, or last longer.

When such practical editorial and advertising information is distributed to the readers of the 23 McGraw-Hill publications, the value of each idea is multiplied by thousands.

So valuable is this interchange of technical information that many companies are surveying their organizations to make sure that the supply of Industrial Magazines is adequate.

▶ If you would like suggestions as to how to conduct such a survey, just write to Reading Counselor Department, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York.

★ ★ ★

THE McGRAW-HILL NETWORK

More than 1,000,000 of the executives, designers and production men, who give America her world supremacy in technical "know-how", use the editorial and advertising content of the 23 McGraw-Hill publications as a means of exchanging ideas.

THE McGRAW-HILL BOOKS

Technical, engineering and business books for colleges, schools, and for business and industrial use.

McGRAW-HILL PUBLISHING COMPANY, INC.
330 WEST 42nd STREET • NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL PUBLICATIONS

American Machinist
Aviation
Bus Transportation
Business Week
Chemical & Metallurgical Engineering
Coal Age
Construction Methods
Electrical Contracting
Electrical Merchandising
Electrical West
Electrical World
Electronics
Engineering & Mining Journal
E. & M. J. Metal and Mineral Markets
Engineering News-Record
Factory Management & Maintenance
Food Industries
Mill Supplies
Power
Product Engineering
Textile World
Transit Journal
Wholesaler's Salesman

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.

(See ¶ on Box Numbers.)

POSITIONS WANTED (full or part-time salaried employment only), ½ the above rates.

PROPOSALS, 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

The advertising rate is $6.30 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. P.

NEW ADVERTISEMENTS received by August 11 will appear in the September issue, subject to limitations of space available.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 32 years' recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 270 Delward Bldg., Buffalo, N. Y.

POSITIONS WANTED

CHIEF ENGINEER: 14 years experience, age 33. Industrial concern preferred. Pulverized Coal experience. PW-298, Power, 330 W. 42nd St., New York, N. Y.

MECHANICAL ENGINEER. Age 36. Graduate. Offers 13 years of extremely broad experience all phases steel mill and power plant engineering. Desires position of plant or power engineer. Minimum salary $6000. Now employed. Address PW-299, Power, 520 N. Michigan Ave., Chicago, Ill.

OPERATING ENGINEER—Desires responsible position in operation and maintenance, of new industrial or utility power plant. 14 years experience with high and low press. all types of fuel, combustion, modern turbines and switchboards. Age 32, class 3A. Location not important. PW-300, Power 68 Post Street, San Francisco, Cal.

CHIEF OPERATING ENGINEER — Thirty years experience covering a very wide range of training in the operation and maintenance of utility central stations, substations and industrial power plants. Thoroughly familiar with H.P. Pulverizer and stoker fired boilers. Technical school graduate. Many years in responsible supervisory positions. References furnished. PW-301, Power, 330 W. 42nd St., New York, N. Y.

FREE BULLETIN

FOR IMMEDIATE DELIVERY—Stock list of rebuilt motors, generators, motor-generator sets and welding equipment. 24-pages, 5¾ x 9, indexed. Write L. J. Land and Company, 146 Grand St., New York, N. Y.

WANTED

ANYTHING within reason that is wanted in the field served by Power can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

REPRESENTATIVES WANTED

Established engineering company producing supplementary power plant equipment desires additional representatives. Reply to

R.W.-302, Power
330 West 42nd St., New York City

LIST OF MAJOR EQUIPMENT ITEMS USED IN THE CONSTRUCTION OF KINGSLEY DAM AND STILL ON HAND AT MARTIN, NEBRASKA.

Write for prices and further particulars to:

MINNEAPOLIS DREDGING CO.—MARTIN WUNDERLICH CO.

OGALLALA, NEBRASKA

1—28″ **Booster Dredge Pump** direct connected to a General Electric 2500 H.P., 6600 Volt, 3 phase, 60 cycle—240 RPM Induction Motor, complete with all switchgear and accessories. Also have a good supply of parts for same.

3—18″ **Morris Dredge Pumps** direct connected to Electric Machinery Co. 800 HP. 3 phase—60 cycle—6600 Volt 450 RPM Synchronous motors together with necessary switchgear. Capacity 12,000 G.P.M. at 170 foot head. Also have supply of parts.

1—18″ **Morris Dredge Pump** direct connected to Westinghouse 800 H.P. 3 phase—60 cycle, 6600 Volt 450 RPM Induction Motor complete with switchgear, resistor grids and drum controller.

4—800 H.P. **Electric Motors.** See above as would sell separately.

1—28′ **Steel work boat** powered by Chrysler 70 H.P. Ace Marine Engine. Fitted with 2½ to 1 reduction gear 22x18 R.H. propeller and towing knees. Dimensions 28 feet by 6 feet six inches by 2 feet six inches.

1—20 cubic yard **steel hopper bin** mounted on 30′ H Beam legs.

1—**Rectangular steel bin** 20′ long, 10′ wide and 12′ deep.

2—**Robins Conveying Belt Co. Reciprocating Plate Feeders** 3′ wide by 12′ long. Rated 250 Cubic Yard capacity per hour each.

5—**Panel Switchboard** complete with 15,000 Volt 600 amp. Oil Circuit Breakers, transformers, relays, meters, etc.

Also Miscellaneous Electrical Hardware, Switches, cable, and motors, pipe valves, rubber sleeves, and dresser couplings, fittings, tools, small pumps, etc.

WRITE FOR COMPLETE LIST.

"TECHNICAL ABILITY and MANPOWER"

to do your

Electrical and Mechanical Designing!

Complete Plan Preparation—Specifications
Estimates—Installation Supervision
Industrial Plant Planning
Layouts—Production Systems, etc.
Ample Facilities—Maintained Schedules

Write—Wire or Phone

Equipment Engineering Associates

Telephone—ANDover: 3420-21
64 W. Randolph St. CHICAGO, Ill.

PRICE & COMPANY

CONSULTING ELECTRICAL AND MECHANICAL ENGINEERS

Technical Advisers to the Purchasers of Used Steam and Electrical Equipment

Inspection Redesign Reports
Installation Supervision

88 Broad Street, Boston, Massachusetts

ADELBERT B. PRICE
Registered Professional Engineer

FOR SALE BY OWNER
PULVERIZED COAL EQUIPMENT

1—Riley Atrita Unit Pulverizer, size 3B
1—Riley Horizontal flare type Burner, size 2 FD With fittings and accessories but not including motor.
Suitable for a boiler of from 500 to 1000 H.P.
The above equipment is new and available for immediate shipment without any priority requirements.

FS-296, Power
330 W. 42nd St., New York City

Don't forget

THE BOX NUMBER . . .

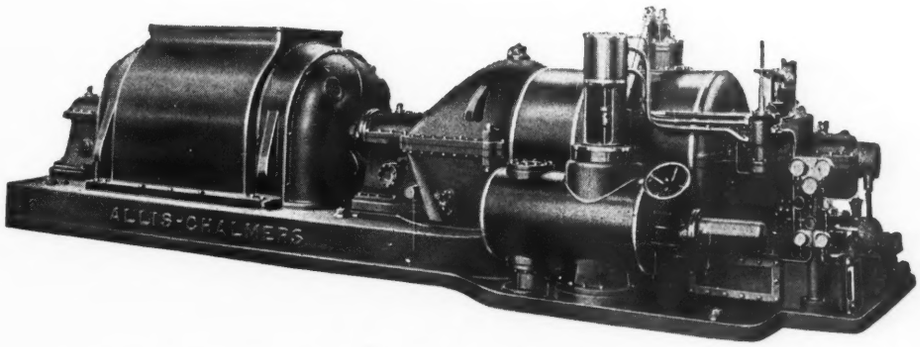
when answering the classified advertisements in this magazine. It is our only means of identifying the advertisement you are answering.

(Equipment Wanted—See page 298)

DEPENDABLE

Turbo-Generators

It is the Practice of this Company to Confine its Inventory Strictly to Comparatively Modern, Little Used Turbines Some Are Practically New



2—Allis-Chalmers, 2500-KVA, 3/60/2300-volt, 200#-P, 500°F-TT, Surface Condensers

PART OF OUR INVENTORY—BELOW

1—Westinghouse 6250-KVA, 3/60/2300-v, 200# 500°F. TT. Surface Condenser.

1—Allis-Chalmers 4000-KVA, 3/60/2300-v, 200#, 500°-F, TT, Condensing.

1—G.E., 2500-KVA, 3/60/600-v, 200# 500° F. TT. Condensing.

1—G.E., 1563-KVA, 3/60/2300-v, 175#, 100° SH, 28". Surface Condenser.

1—Westinghouse, 1563 KVA, 3/60/2400 volts, 200#, 100° SH. Condensing, Modern.

1—Westinghouse 1250 KVA, 250-volt, Direct Current, Condensing, 150/200# pressure. Surface Condenser.

1—Allis-Chalmers 1250-KVA, 3/60/2300-v, 200#, 500° TT. Surface Condenser.

1—G.E., 1250-KVA, 3/60/480-v, 175#-P and 16# Abso. Mixed Pressure.

1—G.E., 937-KVA, 3/60/2300-v, 200#, 500°-TT, 3-Stage Condensing.

1—Allis-Chalmers, 937-KVA, 3/60/2300-v, 200#, 500°-TT, Condensing Surface Condenser.

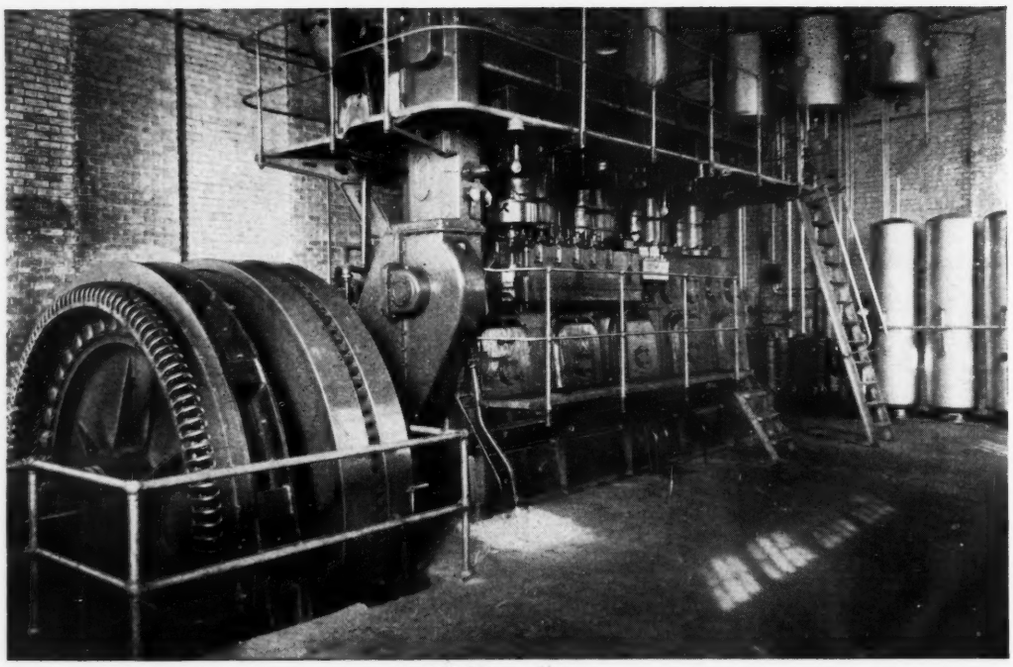
1—G.E., 625-KVA, 3/60/2300-v, 200# 500° TT. Condensing.

1—G.E., 625-KVA, 3/60/600-v, 250#, 550°F-TT, Condensing Modern.

WILMS, WEAVER & CO. Union Guardian Bldg. DETROIT, MICH.

We Deal in Turbo-Generators Exclusively

ELECTRICAL POWER



Actual Photograph

800 KVA WESTINGHOUSE-DE LA VERGNE FULL DIESEL OIL ENGINE UNIT

800 KVA WESTINGHOUSE alterating current generator type ES 3 phase 60 cycle 480/600/2300 volts 180 RPM direct connected to 940 HP De La Vergne full diesel oil engine type 1 model VB 5 cylinder 180 RPM.

The above unit is complete with all accessories as in operation. Installed new 1932.

ALTERNATING CURRENT ENGINE GENERATORS

3 Phase 60 Cycle

210 KVA GENERAL ELECTRIC—AMES Uniflow, 125-150 lbs. 0-5 lb. back pressure, 2300/600/480/240 volts

ALTERNATING CURRENT ENGINE TYPE GENERATORS

3 Phase 60 Cycle

1563 KVA ALLIS CHALMERS, 2400/600 volts, 257 RPM

1250 KVA ALLIS CHALMERS, 2400/600 volts, 257 RPM

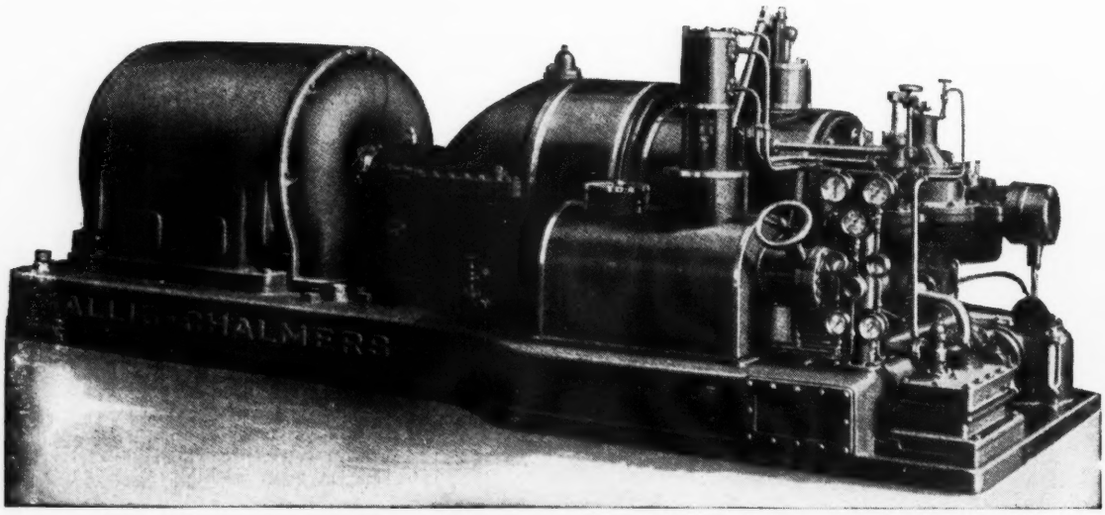
210 KVA GENERAL ELECTRIC, 2300/600/480/240 volts, 225 RPM

DIRECT CURRENT ENGINE GENERATORS

125/250 Volts 3-Wire

150 KW CROCKER WHEELER—Ames 3 cylinder vertical Uniflow, 200-250 lbs. 0-8 lbs. back pressure

125 KW CROCKER WHEELER—Ames 3 cylinder vertical Uniflow, 200-250 lbs. 0-8 lbs. back pressure



Actual Photograph

1000 KW ALLIS CHALMERS CONDENSING TURBO UNIT

1000 KW 80% P.F. 1250 KVA Allis Chalmers alternating current generator 3 phase 60 cycle 2300 volts 3600 RPM direct connected to 1000 KW Allis Chalmers condensing turbine 150-200 lbs. steam pressure 100 deg. superheat. Equipped with jet condenser and auxiliaries.

THE NATIONAL POWER M

ER EQUIPMENT

ROTARY CONVERTERS

60 Cycle

3500 KW (2) WESTINGHOUSE, 225-285 volts D.C., 225 RPM with 3 phase 60 cycle 13200 volt transformers

2500 KW WESTINGHOUSE, 600 volts D.C., 400 RPM with 3 phase 60 cycle 11000 volt transformers

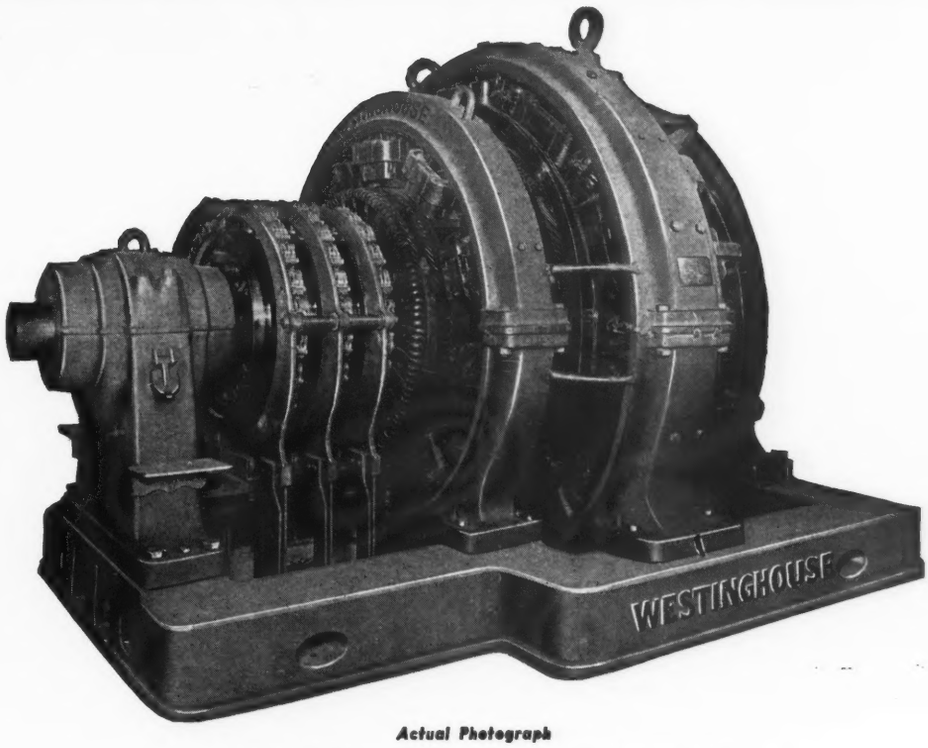
1500 KW WESTINGHOUSE, 225-285 volts D.C., 450 RPM with 3 phase 60 cycle 2300/4000-6900/12000 volt transformers

750 KW GENERAL ELECTRIC, 600 volts D.C., 1200 RPM with 3 phase 60 cycle 2300/4000 volt transformers

ROTARY CONVERTER

25 Cycle

1500 KW WESTINGHOUSE, 600 volts D.C., 500 RPM with 3 phase 25 cycle 11000 volt transformer



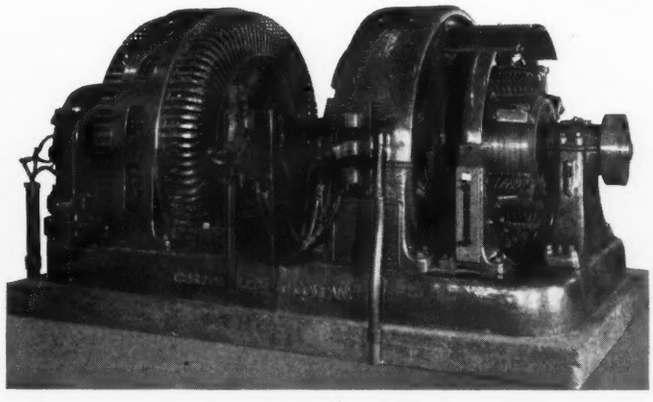
Actual Photograph

1500 KW WESTINGHOUSE ROTARY CONVERTER

1500 KW WESTINGHOUSE interpole rotary converter, 225/285 volts DC 450 RPM; 6 phase 60 cycle A.C. 2300/4000-6900/12000 volt transformers. Complete with control.

MOTOR GENERATOR SETS

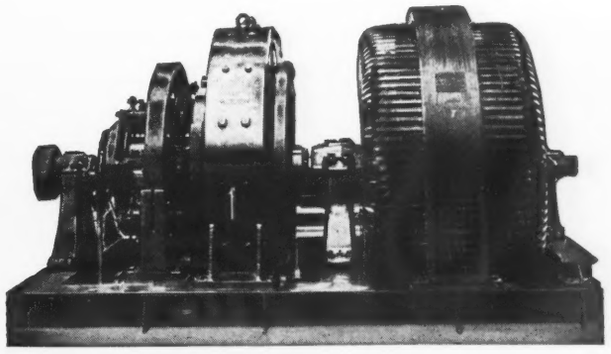
3 Phase 60 Cycle



Actual Photograph

750 KW GENERAL ELECTRIC MOTOR GENERATOR SET

750 KW GENERAL ELECTRIC direct current generator, 600 volts 720 RPM direct connected to 1100 HP 80% P.F. General Electric synchronous motor 3 phase 60 cycle 2300 volts 720 RPM. Equipped with D.C. control panel and starting equipment.



Actual Photograph

1000 KW GENERAL ELECTRIC MOTOR GENERATOR SET

1000 KW GENERAL ELECTRIC direct current generator, 125/250 volts 3-wire 720 RPM direct connected to 1400 HP 80% P.F. General Electric synchronous motor 3 phase 60 cycle 13200/6600 volts 720 RPM. Equipped with D.C. breakers.

R MACHINERY CO. 1921 SCRANTON RD. CLEVELAND, OHIO

POWER PLANT MACHINERY

Available Immediate Delivery

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

6250 KVA Westinghouse condensing 175-200 lb. pressure, 2300 volts, complete with surface condenser and auxiliaries.

1875 KVA G.E. condensing 225 lb. pressure, 600° T.T. 2300 volts, 3600 RPM, complete with condenser.

1563 KVA G.E. condensing 175-200 lb. pressure, 500° T.T., 2300 volts, 3600 RPM, complete with surface condenser and condensing auxiliaries.

1250 KVA ALLIS condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with Wheeler surface condenser.

937 KVA G.E. condensing 200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with condenser, exciter, switchboard and instruments.

937 KVA Westinghouse automatic extraction condensing, 150-200 lb. pressure, 10 lb. bleeder, 480 volts, 3600 RPM, complete with direct connected exciter and switchboard.

937 KVA ALLIS condensing 200 lb. pressure, 100° SH, 2300-550-480 volts, 3600 RPM complete surface condenser with auxiliaries, direct connected exciter—Modern and practically new.

937 KVA ALLIS condensing 150 to 200 lb. pressure, 475° TT, 2300 volts, 3600 RPM, complete with direct connected exciter, surface condenser and auxiliaries.

781 KVA Elliott automatic extraction condensing 200 lb. pressure, 100° superheat, 5 lb. bleeder, 2300 volts, 3600 RPM, complete exciter, switchboard, surface condenser and auxiliaries. Modern.

750 KVA G.E. condensing, 150-200 lb. pressure, 2300 volts, 3600 RPM, complete surface condenser and exciter set.

625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM, complete with condenser and auxiliaries.

375 KVA G.E. condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with surface condenser auxiliaries.

MOTOR GENERATOR SETS

1500 KW ALLIS 600 volt direct current generator direct connected to a 2190 HP, 3 phase, 60 cycle, 4000 volt, 300 RPM synchronous motor.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle—Alternating Current

1125 KVA G.E. 480 volts, 150 RPM direct connected 24"x46"x33" Erie-Ball cross compound engine, complete exciter, and rheostats.

1000 KVA G.E. 480 volts, 150 RPM direct connected 31"x36" Skinner Unaflow engine, complete exciter, switchboard panel and instruments.

500 KVA G.E., 240/480 volts, 150 RPM direct connected 26"x32" Skinner Universal Unaflow non-condensing engine, 130-160 lb., 6 lb. back pressure, complete exciter and rheostats.

500 KVA G.E. 240 volts, 120 RPM direct connected 20"x42" Rice Sargent Corliss non-condensing engine, 125-150 lb., 10 lb. back pressure.

312 KVA G.E. 240 volts, 200 RPM direct connected to 21" x 24" Skinner Unaflow engine complete exciter, switchboard panel and instruments.

210 KVA Westinghouse, 480 volt, 257 RPM alternating current generator direct connected to Winton vertical *Diesel* oil engine.

100 KVA WESTINGHOUSE, 240 volts, 277 RPM direct connected 14"x14" Ames Unaflow engine, 125-150 lb. pressure, 5 lb. back pressure.

ENGINE-GENERATOR UNITS

Direct Current

500 KW G.E. 250 volts, 150 RPM direct connected 26"x36" Skinner Universal Unaflow non-condensing engine.

300 KW WESTINGHOUSE 250 volts, 175 RPM direct connected 24"x26" Skinner Unaflow non-condensing engine, 110-150 lb. pressure, 5 lb. back pressure, complete switchboard and instruments.

250 KW Westinghouse 1000 amperes, 250 volts, 200 RPM direct connected 23"x24" Ames Unaflow engine, 125-150 lb. pressure, complete switchboard and instruments.

150 KW G.E., 1200 amps., 125 volts, 225 RPM direct connected 19" x 20" Ames Unaflow engine, 110 to 140 lb. pressure, complete with switchboard and instruments.

MOTORS

3 phase, 60 cycle

875 HP, WESTGH. 440 V., 240 RPM synchronous.

620 HP G.E. type ATI, form S, 440 volt, 164 RPM synchronous.

400 HP, G.E. type TS, Form AL, 440 V. 300 RPM synchronous.

400 HP, WESTINGHOUSE type CW, 440 V., 500 RPM, slip ring.

300 HP, 80% P.F. WESTINGHOUSE 2300 V., 200 RPM synchronous.

200 HP G.E. 2200 V., 580 RPM squirrel cage.

MOTORS (Con't)

3 phase, 60 cycle

150 HP (2) G.E. 440 volts, 1800 RPM squirrel case.

125 HP, (3) 80% P.F. Elec. Mchy. 410 V., 400 RPM synchronous with starting equipment.

125 HP, 80% P.F. Elec. Mchy. 440 V., 514 RPM synchronous.

50 HP, type I, form M, 3 phase, 60 cycle, 2200 volts, 1200 RPM slip ring.

50 HP, (2) G.E. form K, 220 V., 900 RPM squirrel cage.

50 HP Allis-Chalmers, 440 volts, 600 RPM squirrel cage.

MOTORS

230 VOLT DIRECT CURRENT—SERIES WOUND

175 HP G.E. type MDS, 475 RPM.

35 HP (2) G.E. type CO, 640 RPM.

30 HP (2) G.E. type MDS, 600 RPM.

MISCELLANEOUS

250 KW CROCKER-WHEELER 250 volt, 600 RPM compound wound interpole direct current generator.

1500 KVA, 3 phase, 60 cycle, 22,000 volt primary, 2300 volt secondary WESTINGHOUSE transformer.

900 KW G.E. 3 phase, 60 cycle, 480 volt, 150 RPM alternating current generator with exciter.

500 KVA IDEAL, 3 phase, 60 cycle, 240 volts, 400 RPM, three-bearing belted type generator with direct connected exciter and rheostats.

312 KVA WESTINGHOUSE, 3 phase, 60 cycle, 2300 or 220 volts, 200 RPM, engine type generator with belt driven exciter and rheostats.

300 KVA General Electric, 3 phase, 60 cycle, 440 volt, 600 RPM, three bearing belted generator complete with switchboard.

200 KVA WESTINGHOUSE, 3 phase, 60 cycle, 240 volts, 200 RPM engine type generator with rheostat.

1 ELLIOTT EHRHART jet condenser with all auxiliaries suitable for operation with a 5000 KW turbine-generator unit.

1500 sq. ft. WESTINGHOUSE surface condenser.

1055 cubic feet, 100 lb. air pressure CHICAGO PNEUMATIC horizontal compressor direct connected to 170 HP, 240 V., 150 RPM General Electric direct current motor.

SPECIAL

1—PRACTICALLY NEW WESTINGHOUSE FREQUENCY CHANGER SET CONSISTING OF:

655 HP, 3 phase, 25 cycle, 2200 volts, 300 RPM synchronous motor direct connected to 565 KVA 80% P.F., 3 phase, 60 cycle, 240 volt, alternating current generator complete and equipped with direct connected exciters, all panels with instruments.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

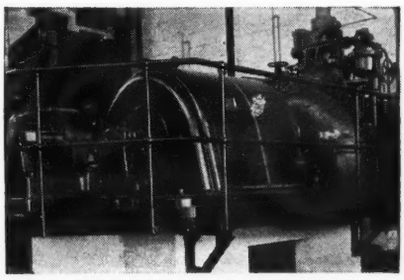
WIRE OR PHONE
LONG DISTANCE 422

"Convert · · · or else!" SAYS UNCLE SAM

Forced conversion of thousands of manufacturing plants to war production in 1942 is dead certain. Many readers of POWER will be directly affected, especially the plant engineer . . . When his factory "converts" to war work, as thousands will, the management will expect him to reach out into the thin air and gather all things needful to deliver enough air and steam and electricity and mechanical power to all the new productive machines in their new locations in buildings old and new.

from POWER

•Depend on "HEMPHILL" for the needed Power Equipment!



MOTOR GENERATOR SETS

1—500 KW, 650 volt, General Electric, syn.
1—50 KW, 250 volt, General Electric, sq. cg.
1—35 KW, 125 volt, El. Mach., sq. cg.
1—52½ KW 35 volt Westinghouse.
1—20 KW, 600 volt, G.E. sq. cg.
1—10 KW 125 volt Electric Machinery
1—16 KW 125/250 volt Westinghouse

D. C. GENERATORS

1—250 KW, 600 RPM, 250 volt, Sprague.
1—75 KW, 260 RPM, 250 volt, Westinghouse.
1—75 KW, 675 RPM, 125 volt, Westinghouse.

MOTORS—3 PHASE 60 CYCLE

1—720 HP, 360 RPM, 440 volt, G.E., syn.
1—500 HP, 450 RPM, 2200/4000 volt, G.E., slip ring.
1—400 HP, 514 RPM, 440 volt, Westg., sl. rg.
1—350 HP, 300 RPM, 440 volt, G.E., slip ring.
1—350 HP, 100 RPM, 220/440 volt, G.E. syn.
1—335 HP, 600 RPM, 2300 volt, G.E., syn.
1—300 H.P. 720 RPM, 2200 volt, G.E., Sl. Rg.
1—250 HP, 360 RPM, 440 volt, Westg. sq. cg.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 H.P. 600 RPM, 4000 volt, G.E. Sync.
1—200 HP, 900 RPM, 440 volt, Westg., sl. rg.
1—200 HP, 600 RPM, 2200 volt, G. E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 2300 volt, Allis Chal. sq. cg.
1—150 H.P. 1800 RPM, 440 volt, West. Sq. Cg.
1—150 HP, 900 RPM, 440 volt, Allis Chal. sl. rg.
1—150 H.P. 1200 RPM, 440 volt, G.E. Sq. Cg.
1—150 HP, 720 RPM, 440 volt, G.E., slip ring.
1—150 HP, 600 RPM, 440 volt, G.E., slip ring.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
2—125 HP, 720 RPM, 440 volt, G.E., slip ring.
2—125 HP, 450 RPM, 440 volt, G.E., syn.
1—100 HP, 900 RPM, 220 volt, G.E., sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., slip ring.
3—100 HP, 720 RPM, 440 volt, G.E., slip ring
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., slip ring.

MOTORS—3 PHASE 60 CYCLE—(Continued)

1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.
2—100 HP, 450 RPM, 440 volt, G. E., sq. cg.

MOTORS—D. C. 230 VOLTS

1—100 H.P. G. E. 575 RPM
1—100 H.P., 625 RPM, G.E.
1—65 HP, 1000 RPM, G. E., type RC.
1—50 HP, 1100 RPM, Crocker Wheeler.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
50 H.P. 750 RPM. G. E. CO1829
45 H.P. 1300 G. E. Type RC
1—40 HP, 1100 RPM, G.E., type RC.
1—40 HP, 300 RPM, General Electric.
1—30 HP, 750 RPM, G.E., type RC.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—75 HP, 235/950 RPM, Burke.
1—60 HP, 600/1200 RPM, General Electric.
1—30 HP, 225/900 RPM, Crocker Wheeler.
1—20 HP, 750/1500 RPM, General Electric.
1—5 HP, 600/1200 RPM, General Electric.
6—5 HP, 400/1200 RPM, Westinghouse.
1—5 HP, 225/900 RPM, Electro Dynamic.

ALTERNATORS

1—625 KVA, 450 RPM, 600 volt, Westg.
1—625 KVA, 3600 RPM, 600 volt, G.E.
1—400 KVA, 400 RPM, 240 volt, Westg.
1—375 KVA, 200 RPM, 240 volt, Elec. Mach.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—37½ KVA, 1200 RPM, 2400 volt, Westg.

TURBO-GENERATORS

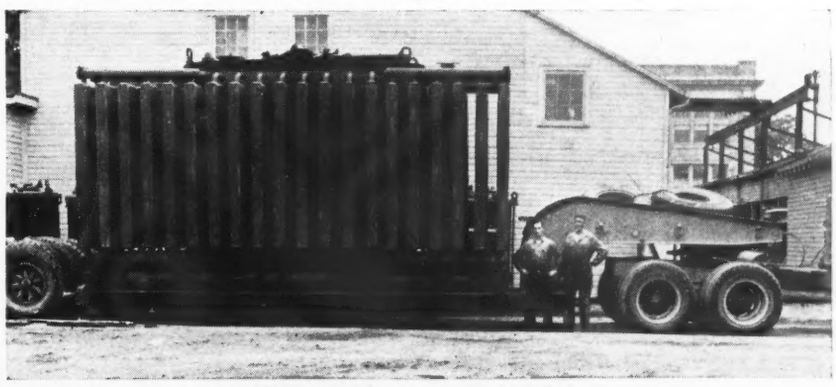
2—1000 KW, 3 ph., 60 cy., 2300/4150 v., cond.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v. cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

TRANSFORMERS

2—400 KVA, G.E., 4150-240/480 v., Scott taps
3—300 KVA, Pittsburgh, 7800/440 volts.
1—200 KVA, Pittsburgh, 7800-110/220 volts
3—150 KVA, G.E., 33,000-2300/4000 Y.
3—150 KVA, Pittsburgh, 6600/440 volts.
4—150 KVA, G.E., 3 ph., 4150-120/208 v.
3—125 KVA, General Electric, 2300/480.
3—100 KVA, Westinghouse, 13200 250 volts
1—75 KVA, Pittsburgh, 7600-110/220 volts.
3—50 KVA, Wagner, 4150-220 volts.
4—50 KVA, Westg., air cooled, 440-220/220 110 v.
3—50 KVA, Westinghouse, 220-110/220 volts
3—50 KVA, G.E., 2200-110/220 volts.
52—37½ KVA, 2200-220/110 v.
10—25 KVA, Westg., air cooled, 440/220-110 v.
3—25 KVA, Moloney, 2200-220/110 volts.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.
1—15 KVA, G.E., 440/110-220 volts.
4—10 KVA, G. E., 2300-115/230 volts.
3—7½ KVA, G.E., 440-110/220 volts.

OIL CIRCUIT BREAKERS

1—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-24.
1—1600 amp., 7500 v., 4 pole, Westg., B-2.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.



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THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.

1—12000 KW General Electric Cond.
1— 6250 KVA General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 2850 KVA Westinghouse Cond.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 750 KVA Terry Double Extr. Cond.
1— 375 KVA General Electric Cond.
1— 250 KVA General Electric Cond.
1— 938 KVA West. 375# I.P. 100# B.P. N-C
1— 375 KVA General Electric Non-C.
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.

1—1067 KVA Nordberg Uniflow
2— 937 KVA Nordberg Uniflow
1— 500 KVA Rice & Sargent Corliss
1— 375 KVA Erie City Slide Valve
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 250 KVA Harrisburg Uniflow
1— 250 KVA Erie City Slide Valve
1— 150 KVA Hamilton Poppet Valve

DC STEAM ENGINE UNITS

1—500 KW Skinner Uniflow 250 V.
1—350 KW Ridgway 4-valve 250 V.
1—300 KW Skinner Uniflow 250 V.
1—300 KW Erie City 4-valve 250 V.
1—200 KW Chuse 4-valve 250 V.
1—200 KW Skinner Uniflow 250 V.
1—150 KW Erie Ball 4-valve 250 V.
1—150 KW Ames Uniflow 125 V.
1—100 KW Ames Uniflow 120 V.
1— 75 KW Skinner Uniflow 250 V.
1— 50 KW Ames Uniflow 125/250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.

1—400 KW West. (gas) 440 V.
1—93.5 KVA Anderson 2300 V.
1— 75 KVA Fair.-Morse 2300 V.
1— 40 KVA Fair.-Morse 2300 V.

WATER TUBE BOILERS

4—750 HP Edge Moor 200-lb.
6—600 HP Stirling 180-lb. Stokers
2—520 HP Heine 200-lb. Hand Fired
2—490 HP Stirling 200-lb.
2—407 HP Erie City 250-lb. Stokers
1—400 HP Stirling 200-lb.
1—400 HP B. & W. 160-lb. Stoker
2—360 HP Erie City 180-lb. Pulverized Coal
2—357 HP Casey-Hedges 175-lb. Stokers
2—350 HP Stirling 200-lb.
2—302 HP B. & W. 160-lb. Hand Fired
2—282 HP Edge Moor 200-lb. Stokers
2—270 HP Erie City 180-lb. Pulverized Coal
2—160 HP Stirling 155-lb. Hand Fired

SYNCHRONOUS MOTORS—60 Cy.

2—800 HP Electric Maehy. 6600 V. 450 RPM
1—175 HP General Electric 440 V. 400 RPM
1—175 HP General Electric 230 V. 225 RPM
1—150 HP General Electric 440 V. 164 RPM
2—120 HP General Electric 440 V. 400 RPM
1—100 HP General Electric 4000 V. 900 RPM
1—100 HP General Electric 2300 V. 240 RPM

INDUCTION MOTORS—60 Cy.

2—400 HP G. E. slip ring 3800 V. 1800 RPM
2—300 HP G. E. sq. cage 440 V. 600 RPM
2—250 HP G. E. sq. cage 4000 V. 1200 RPM
1—250 HP G. E. slip ring 2200 V. 450 RPM
5—150 HP West. sq. cage 440 V. 900 RPM

AIR COMPRESSORS

1—3500 Ft. 100-lb. Ing. PRE2, 60 cy. motor
1—3300 Ft. 100-lb. Ing. PRE2, 60 cy. motor
1—2600 Ft. 100-lb. Ing. PRE2, 60 cy. motor
1—2100 Ft. 65-lb. Worth. 60 cy. motor
1—1300 Ft. 100-lb. Sullivan Diesel
1—1200 Ft. 100-lb. Ing. 2-stage, belt driven
1—1052 Ft. 100-lb. Ing. XRE, 60 cy. motor
2— 600 Ft. 100-lb. Ing. POC2. Diesel

OIL CIRCUIT BREAKERS

1— 800 A. 87 KV Am.Br. Bov. AF22 Outdoor
2— 600 A. 73 KV West. G222AS Outdoor
1— 400 A. 73 KV G. E. FKO36 Outdoor
2— 600 A. 37 KV Conduit FO40A Outdoor
1— 400 A. 37 KV G. E. FKO-37 Outdoor
4— 400 A. 34.5 KV Condit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB-76 Outdoor
2— 600 A 15 KV Kelman CB-76 Outdoor
1— 400 A. 15 KV G. E. FK037 Outdoor

FREQUENCY CHANGERS

2—3125 KVA West. 25/62½ cy. 750 RPM
1—3000 KVA G.E. 60/25 cy. 300 RPM
1—2500 KVA West. 25/60 cy. 300 RPM
1—1500 KW G. E. 25/60 cy. 300 RPM
1—1250 KVA G. E. 25/62½ cy. 375 RPM
1—1000 KVA G. E. 60/25 cy. 514 RPM
1— 750 KVA G. E. 25/60 cy. 300 RPM
1— 500 KVA G. E. 25/50 cy. 300 RPM

ROTARY CONVERTERS—60 Cy.

1—1250 KW General Electric, 240 V.
2—1000 KW General Electric, 600 V.
2— 500 KW General Electric, 250 V.
1— 500 KW General Electric, 600 V.
2— 300 KW General Electric, 600 V.

SYNCHRONOUS CONDENSERS

1—4000 KVA G. E. 13200 V. 514 RPM
1—2000 KVA G. E. 11000/2200 V. 720 RPM
1—2000 KVA C. W. 11000 V. 600 RPM
1—1000 KVA G. E. 2300 V. 900 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.

3— 600 KVA West. 120,000/2300 V.
1— 5000 KVA Allis 72000/6600 V. 3 ph.
3— 500 KVA West. 66000/2400
3— 500 KVA Allis 33000/480 V.
2— 1000 KVA G. E. 23000-11500/575 V.
3— 250 KVA G. E. 22000/11000 V.
3— 100 KVA G. E. 22000/6900 V.
3— 100 KVA Allis 22000/440 V.
1—10000 KVA Pitts. 13200/4600 V. 3 ph.
2— 5000 KVA American 13800/2300 V.
5— 1000 KVA G. E. 13800/2300 V.
1— 450 KVA G. E. 13200/240-480 V. 3 ph.
3— 150 KVA Pitts. 13800/230-460 V.
3— 75 KVA West. 13800/230-460 V.
3— 1000 KVA Packard 11000/2300-4000 V.
3— 150 KVA Pitts. 11000/2400 V.
3— 100 KVA West. 11000/250-125 V.
1— 3300 KVA G. E. 6600/110 V. 3 ph. Furnace
1— 1500 KVA West. 6600/106 V. 3 ph. Furnace
3— 1250 KVA G. E. 6600/550 V.
3— 100 KVA G. E. 6900/440-220 V.
3— 833 KVA Penn. 4800/120-240 V.
3—1000 KVA Pitts. 2300-4600/550 V.
4— 150 KVA G. E. 2300/115-230 V.
3— 100 KVA West. 2400/120-240 V.
6— 50 KVA G. E. 2400/240-120 V.

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50 CHURCH STREET, NEW YORK CITY

SUCCESSFUL OPERATION GUARANTEED

Every Machine in This Ad is Owned Outright By Us

D C MOTORS

230 Volt—Constant Speed

	HP	Make	Type	Speed
1—	300	Cr. Wh.	CCM-108H	550
1—	250	Al. Ch.		525
2—	200	Whse.	SK	400
1—	200	G.E.	DMC	475
1—	150	G.E.	MPC	275
1—	140	G.E.	MDS-108	410
1—	125	G.E.	CDP-123	1750
3—	100	G.E.	LC-50	1200
1—	100	G.E.	RC-38	600

230 Volt—Adjustable Speed

1—	600	Whse.		150/275
1—	300	G.E.	MPC	250/400
1—	300	G.E.	MPC	275/550
2—	275	G.E.	DMC	500/750
1—	200	Whse.		400/500
1—	150	G.E.	MPC	250/450
3—	150	Whse.	SK-201	300/900
1—	100	Al. Ch.		950/1150
1—	75	Whse.	SK	475/900
1—	75	G.E.	CD-145	575/865
1—	75	Cr. Wh.	65-H	600/1200
1—	75	G.E.	C	500/1000
2—	60	El. Dy.	S	525/1050
2—	50	Cr. Wh.	CMC-81H	300/900
1—	45	G.E.	CD-125	450/1350
24—	30	Whse.	SA	500/1500

TRANSFORMERS

	KVA	Make	PH	Type	Voltages
1—	1500	Whse.	3	OISC	26400/13200x460
3—	1000	G.E.	1	HKDD	13800x2300
3—	333	Pitts.	1	OISC	13800x440/220
3—	300	G.E.	1	H	13200x2300/575
2—	200	Whse.	1	SK	6900x230/460
3—	200	G.E.	1	H	26400x115/460
3—	100	Whse.	1	OISC	13200x250

SYN. CONDENSER

1 4000 Kva. G.E. 2 unit 3 Brg Condenser set with exciter consisting of Cond. 4000 Kva., 13200 volt, 3 ph. 60 cy. with 1150 HP, 13200 v. motor and 100 KW Exciter.

SYN. MOTOR GENERATOR SETS

3 phase—60 cycle

1—1500 KW G.E. 600 v. Gen. d.c. to 2100 HP 6600 v.
1—500 KW G.E. 600 v. Gen. d.c. to 700 HP 13200 v.
1—250 KW. Cr. Wh. 250 v., Gen. dc to 350 Kva., 6000 v. motor.
1—250 KW G.E. 250 v. Gen. d.c. to 375 HP 220/440/2200 v. motor.
1—200 KW Whse. 250 v. Gen. dc to 290 HP 2200 v. motor.
2—150 KW, G.E., 550 V., Gen. d.c. to 225 H.P., 2200 V. syn. motor.

TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.
1—500 KW, G.E., 625 KVA, 2300 v., 3 ph., 60 cy. generator with Curtis 4 stage, 150 pound condensing turbine complete with condenser, etc.

ROTARY CONVERTERS

60 Cycle

2—1500 KW, Whse. 720 RPM 650 v. DC with 3-single phase, 33000 v. transformers and panel.
2—1000 KW whse. 900 RPM 650 v. DC with 3- single phase 11800 v. transformers and panels.
1—750 KW Whse. 720 RPM 250 v. DC with three phase 6600/2300 v. transformer and panels.
1—500 KW, Westinghouse, 900 RPM, 125/250 volt, DC, with 3- single phase, 60 cycle, 13200/6600/2300 volt transformers and panels
1—300 KW, G.E., type HCC, 1200 RPM., D.C., 600 V. AC, 6 ph., 1200 RPM

ROTARY CONVERTERS

25 Cycle

3—1500 KW GE 225/275 v. DC Booster type each with 1600 KVA, 3 ph. 6765 volt transformers and panels.
1—500 KW GE 225/275 DC Booster type with 500 Kva 3 ph. 6765 volt transformer and panels.

A C MOTORS

3 phase—60 cycles

Synchronous

	HP	Make	Type	Volts	Speed
1—	500	G.E.	TS	440	360
1—	350	Cr. Wh.	301	2200	600
1—	300	G.E.	ATI	440	600
1—	300	G.E.	ATI	2300	600
1—	250	G.E.	ATI	220	450
1—	200	Whse.		440	514
3—	150	G.E.	TRB	220x440	450
1—	150	Whse.		2200/550	1800
1—	100	Whse.		2200/550	1800
1—	100	Whse.	HP	220	300
1—	100	Whse.	G	2300	900

Slip Ring

1—	600	G.E.	IM	2200	900
1—	600	Al. Ch.	ANY	2200	1180
1—	450	Whse.	CW	2200	875
1—	400	G.E.	MT	550/440	300
1—	400	Al. Ch.		2300	505
1—	300	G.E.	IM	2300	585
1—	250	G.E.	MT-410	2300	400
1—	250	Whse.	CW	440	585
1—	250	G.E.	MT	4000/2300	257
2—	200	Whse.	CW	2200	514
1—	200	G.E.	IM	440	435
2—	175	G.E.	IE-15A	2200	880
1—	150	G.E.	IM	2200	695

Squirrel Cage

1—	500	G.E.	1-17B	2200	695
1—	400	G.E.	KT	2300	580
1—	300	Whse.	CS	550	580
2—	300	G.E.	IK	2300	600
1—	300	Al. Ch.		2200	1160
1—	250	Al. Ch.		220/440	1150
1—	200	Whse.	CS	440	580
1—	200	Whse.	CS	550	720
1—	200	Al. Ch.		2200	1750
1—	150	G.E.	IK	2200/440	900
3—	150	Al. Ch.	AN	220/440	1750

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REBUILT POWER EQUIPMENT — Ready to Ship

ROTARY CONVERTERS

150 kw., West. 250 v. rpm., 2200 3 ph. 60 cy.
1—200 kw. G.E. 275 v. 900 rpm., 6 ph. 60 cy. complete with overspeed device and transformers.
1—500 kw. G.E. type HC-8 600 volt, 900 rpm., 6 ph., 60 cy. pedestal bearing with overspeed device complete with transformers.

MOTOR GENERATOR SETS

500 kw. Westinghouse 600 V. 514 rpm., ped. type dir. con. 770 HP., 2200 v. 3 ph. 60 cy. Syn. Motor complete.
350 kw. Westinghouse 250/300 V. D.C. 514 rpm., pedestal type dir. con. Westinghouse Syn. Motor 2200/3/60 complete
200 kw. Westinghouse 600 v. D.C. 600 rpm., dir. con. 2200/3/60 Syn. Motor. Complete.
150 kw. Westinghouse 275 v. 600 rpm., dir. con. 290 HP., 2200 v. 3 ph. 60 cy. Syn. Motor.
125 kw Crocker Wheeler 250 V. D.C. 1200 rpm., 220/440 v., 3 ph. 60 cy. induction
50 kw., Westinghouse 250 v. type SK, 1200 rpm., dir. con. 118 HP., 220/440 v. 3 ph. 60 cy. Syn. Motor 70% P.F. complete

ENGINE GENERATOR SETS

50 kw. 250 V. D.C. International P.D.-80 DIESEL ENGINE.
200 kw. 480 v. 3 ph. 60 cy. direct connected, 300 H.P. Buckeye 4 cylinder vertical Diesel Engine.
225 kw. Elec. Machy. 2200 or 220 v. 2 ph. 60 cy. dir. con. Ideal Steam

100 HP. LIDGERWOOD HOIST

Double drum Speedwell 2500 lb. pull at 450′ per min. direct driven by 100 hp. A.C. or D.C. Motor.

A.C. GENERATORS

219 kva. G.E. 2300/3/60 200 rpm. 80% P.F. (Can be reconnected 440 or 220 v.)

GAS ENGINE GENERATOR SET

75 kw. West. 250 v. belted to 110 HP 2 cyl. Bessemer Gas Engine.

SPECIALS IN SLIPPING MOTORS

3ph. 60 cy.

HP	Make	Speed	Type
1500	Allis Chal.	485	ANY
700	G.E.	393	MT-432
400	West.	1170	CW
400	West.	435	CW
260	Burke	600	EM-65
250	G.E.	600	IP
250	G.E.	590	I-174
200	West.	690	CW-956A
100	West.	1750	CI

SYNCHRONOUS MOTORS

4—150 HP. Allis Chal. 2200/3/60 1200 rpm. 70% P.F. 125 v. exciter dir. conn. thru coupling to 4—Falk Reduction Gears, ratio 1200—164 rpm. complete with control.
1—300 HP Elec. Machy. 2200/3/60 72 rpm. 100% P.F.
1—190 HP Elec. Machy. 2200/3/60 90 rpm.

TURBINE

1—Kerr Economy Steam Turbine 450 B.H.P. 3800 rpm. 5" intake, 12" exhaust with Kerr Reduction Unit 3800 to 720 rpm. 115 lbs. pres.

A.C. MOTORS—3 ph. 60 cy.

HP	Volts	Make	Type	Speed
200	2200	G.E.	IK-15	1200
200	220/440	West.	CS	1200
200	220/440	West.	CS	720
200	220/440	West.	CS	600
300	2300	West.	CS	1200
300	2200/440/220	West.	CS	450
350	2200/440/220	West.	CS	450
400	2200/440/220	West.	CS	500
450	2200/440/220	West.	CS	600
500	2200/440/220	West.	CS	720
600	2200/440/220	West.	CS	900

SPEED REDUCERS

23—3 to 10 HP Thomas, Ratio 100 to 1; 15 to 1; 10 to 1; 5 to 1.
5—10 HP. 600 At Cleveland ratio 90:1.
1—150 HP. R.D. Nuttal ratio 1.6:1.
4—150 HP Falk Co. Reduction Gears, ratio 1200—164 rpm.
2—450 HP Kerr Reduction Gear, 3800 to 720 rpm.

TRANSFORMERS—1 ph. 60 cy.

No.	Kva.	Prl.	Sec.	Make
3	1500	22000	6600	Pgh.
3	150	22000	6900	Pgh.
1	150	2200	230/460	G.E. 3 ph.
1	100	2200	110/220	G.E. 3 ph.
1	100	2200	110/220	West.
3	100	6600	550/440/220	Pgh.
1	100	2200	220/110	West.
3	50	11430/6600	550	Al. Ch.
3	50	6600	575	G.E.
1	50	2200	220	Burke
3	50	2200	110/220	West.
5	50	2200	110/220	G.E.
1	37½	2300	220/440	Wagner
3	37½	22000	2200	West.
3	37	4400	185	West. (Rotary)
1	30	2200	110/220	G.E.
25	25	2200	110/220	G.E.
3	20	2200	110/220	G.E.
10	15	2200	110/220	G.E.
3	15	2300	220/440	Pgh.
35	10	2200	110/220	G.E.
40	10	2200	110/220	West.
100	7½	2200	110/220	G.E.
50	7½	2200	110/220	West.
75	5	2200	110/220	G.E.
50	5	2200	110/220	West.

DUQUESNE ELECTRIC & MFG. CO., Pittsburgh, Pa.

Get what you want IN A HURRY
from L. J. LAND & COMPANY, New York's Largest Stock of Electrical Equipment

A.C. EQUIPMENT

SYNCH. MOTORS

200 H.P. G.E. TS 514 RPM
120 H.P. Elec. Machy, 900 RPM.
60 H.P. Elec. Machy. 1800 RPM
50 H.P. Elec. Mchy. 1200 RPM
47 H.P. West. 1200 RPM .7 PF

SLIPRING MOTORS

300 H.P. General Electric 720 RPM
250 H.P. G.E. 600 RPM
200 H.P. General Electric 514 RPM
200 H.P. G.E. 720 RPM (2)
150 H.P. Allis Chalmers 720 RPM
125 H.P. Burke, 600 RPM.
150 H.P. G.E. 720 RPM
112 H.P. G.E. hoist 720 RPM
100 H.P. Fairbanks Morse 720 RPM
100 H.P. Allis Chalmers 720 RPM
100 H.P. Westinghouse 720 RPM
75 H.P. Westinghouse 1200 RPM
75 H.P. Allis Chalmers 600 RPM
75 H.P. G.E., 600 RPM.
60 H.P. Westinghouse 1200 RPM
60 H.P. General Electric 1200 RPM
60 H.P. General Electric 900 RPM

SQUIRREL CAGE MOTORS

200 H.P. Allis Chalmers 1800 RPM
200 H.P. Allis Chalmers 1200 RPM
200 H.P. General Electric 600 RPM
150 H.P. Al. Ch. 900 RPM
150 H.P. G.E. 600 RPM
150 H.P. West., 1800 RPM (2).
100 H.P. G.E., 720 RPM.
75 H.P. Westinghouse 900 RPM
75 H.P. Burke, 1200 RPM.
75 H.P. Crocker Wh., 1200 RPM.
75 H.P. Allis Ch., 900 RPM.
60 H.P. G.E., 1800 RPM.
50 H.P. G.E. 1800 RPM
50 H.P. G.E., 900 RPM.
50 H.P. West., 900 RPM.
50 H.P. Allis Ch., 720 RPM.
50 H.P. G.E., 720 RPM.
50 H.P. G.E., 600 RPM.

A.C. GENERATORS

200 K.W. General Electric 600 RPM
150 K.W. G.E., 720 RPM.
125 KVA G.E. 900 RPM
100 KVA West., 600 RPM.

A.C. GENERATORS (Continued)

100 KVA Crocker Wheeler 900 RPM
100 KVA Elec. Machy. 1200 RPM
90 KW GE 900 RPM
75 KVA West. 900 RPM (2)

LOW AND HIGH VOLTAGE GENERATORS

200 K.W. Wghse. 600 V. Mtr. Gen Set
2 to 40 K.W. 600 to 2000 V. M.G. Sets (11)
24 K.W. 60 V. General Electric
1 to 75 K.W. 10 to 80 V. (15)

MISCELLANEOUS

12½x12 American Compressor, 390 ft. at 125 lbs. pressure.
2—Triplex Pumps.
14 x 10 Ingersoll Rand Air Comp.
1 Ton Shepard
15 to 50 K.W. Frequency Changers 90, 100, 120 cycle (7)
5 H.P. B & D D.C. Buffer
Fans & Blowers (19)
Tirrell Voltage Regulators

OVER 3,000 A.C. & D.C. Manual and Automatic Starters in Stock.

ONLY PARTIAL LISTING

New York City's Largest Stock Electrical Equipment

ONE YEAR GUARANTEE

L. J. LAND AND CO.

146 Grand Street—Canal 6-3923—New York, N.Y.
Reading, Penna. Office: 10th and Exeter St.
Over Quarter Century Serving Industry

D.C. EQUIPMENT

230 V. D.C. MOTOR GEN. SETS

125 KW Curtis, steam turbine dr.
100 KW G.E., 1200 RPM.
50 K.W. Burke 1200 RPM
45 K.W. Westinghouse 700 RPM

125 V. M.G. SETS

100 K.W. Gen. Elect.
75 K.W. Ridgway Syn. Motor
40 K W. Westinghouse
35 KW Imperial, 1200 RPM.
25 K.W. Gen. Elec.

230 V. D.C. MOTORS

165 H.P. Cr. Wheeler, 670 RPM.
100 H.P. Reliance 1200 RPM (2)
100 H.P. G.E. C.D. 1200 RPM
90 H.P. G.E. C.D. 1200 RPM
85 H.P. General Electric 850 RPM
60 H.P. Sprague 900 RPM
60 H.P. G.E. 1000 RPM
60 H.P. Roth 600 RPM
50 H.P. G.E. 850 RPM
50 H.P. G.E., 1150 RPM.
40 H.P. G.E., 1700 RPM.
40 H.P. Allis Ch., 1150 RPM.
40 H.P. West., 1150 RPM.
40 H.P. Reliance 625 RPM
25 H.P. G.E., 1150 RPM (3).
25 H.P. West., 850 RPM (2).
25 H.P. G.E., 575 RPM.
20 H.P. G.E., 1750 RPM.

230 V. VAR. SPEED MTR.

50 H.P. West. 525/1050 RPM
40 H.P. El. Dyn., 1450/2600 RPM
35 H.P. Ridgway, 300/800 RPM.
35 H.P. West., 400/1200 RPM.
35 H.P. C-W 250/1000 RPM
30 H.P. West. 500/1500 RPM
27 H.P. G.E., CO-2002.
20 H.P. Reliance 400/1600 RPM
15 H.P. West. .825/1650 RPM
15 H.P. Electro Dyn. 450/1350 RPM

115 VOLT D.C. MOTORS

90 H.P. General Electric 900 RPM
65 H.P. G.E., 550 RPM.

MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

3 PHASE—60 CYCLE 220/400 VOLT

H.P.	Make	RPM	Type	Frame
15	Allis-Chalm.	1750	2K54411	
20	Gen. Elec.	1750	KT	753
20	Gen. Elec.	600	I	K
25	Burke	900	EM	
40	Gen. Elec.	900	KT	336
40	Burke	1200	EM	45
40	Westing.	1750	CS	
50	Westing.	900	CS	
50	Gen. Elec.	900	KT	542
60	Burke	900	EM	7
60	Gen. Elec.	1200	I	K
60	Gen. Elec.	1800	I	K
75	Gen. Elec.	1200	KT	343
75	Gen. Elec.	1200	I	K
75	Gen. Elec.	1800	I	K
75	Gen. Elec.	900	I	K
100	Gen. Elec.	1750	I	K
100	Westing.	900	CS	
100	Lincoln	1200		
150	Gen. Elec.	1200	I	
150	Westing.	900	CS	
200	Gen. Elec.	600	I	K
200	Gen. Elec.	720	I	K
200	Gen. Elec.	900	I	K
200	Gen. Elec.	1200	I	K
250	Gen. Elec.	600	I	K
250	Gen. Elec.	720	I	K
250	Allis-Chalm.	900		
300	Gen. Elec.	720	I	K

Compressors in stock up to 300 H.P. Compensators.

WANTED

Write—Wire—or Phone

1—125 or 150 H.P. 230 Volt D.C. Motor, 200/1200 RPM, or any 6—1 ratio. Wire if you have this motor.

MOTOR GENERATOR SETS

1—100 KW. Crocker Wheeler 250 v DC 500 RPM direct connected to 150 HP General Electric Motor 3 PH 25 cycle 2200 volts 500 RPM. complete.

1—35 KW Westinghouse Generator 125 volt DC 1450 RPM direct connected to 53 HP West. CS motor 3 ph. 25 cy. 220 v. 1450 RPM. complete.

1—75 KW Ridgeway 140 v DC 1200 RPM direct connected to 120 HP Ridgeway synchronous motor 3/2200/60/1200 RPM. Complete.

3—100 KW Ridgeway sets 250 v. DC. 1200 RPM direct connected to 150 HP. Ridgeway synchronous motors. 3/2200/60/1200 complete with panels.

DIRECT CONNECTED PUMPS

1—280 G.P.M. Buffalo Pumps, Inc. 30 ft. head direct connected to 3 HP. Westinghouse splash proof motor, 3 phase, 25 cycle, 1450 rpm.

2—400 G.P.M. Buffalo Pumps, Inc. 30 ft. head direct connected to 5 HP. Westinghouse splash proof motor, 3 phase, 25 cycle, 1450 rpm.

3—350 G.P.M. Buffalo Pumps, Inc. 40 ft. head direct connected to 5 HP. Westinghouse splash proof motor, 3 phase, 25 cycle, 1450 rpm.

TRANSFORMERS

Amt.	Kva.	Make	Cycle	Voltage
3	40	G. E.	25	2200/440
3	50	Whse.	25	2200/110/220
3	50	Whse.	25	11000/2200
3	100	Whse.	60	2200/220/440
3	100	Whse.	60	4600/330/460
3	100	G. E.	25	2200/220/440
3	100	G. E.	25	11000/2200
3	200	G. E.	60	2400/220/440
3	200	G. E.	60	4600/230/460
3	200	G. E.	60	6600/220/440
3	500	Pitts.	25	11500/100
3	1000	Pitts.	60	2300/4600/230/460

FREQUENCY CHANGERS

94 KVA Westinghouse Synchronous Set Generator, 62½ cy., 230 v., 750 RPM with panels. Motor 112 HP. 3/25/2300/750 Synchronous with starting equipment.

1—120 KVA Gen. Elect. Induction Frequency changer, 440 volts 3 ph. 62½ cy. Driving motor 100 HP. 3 PH. 440 volt 25 cycle 720 RPM. Complete.

200 KW, Gen. Elec. 3 ph, 60 cy. 2300 v. direct connected to 290 HP Gen. Elec. Synchronous motor 3 ph. 25 cy. 440 v. complete with panels.

SPECIAL MOTORS

1100 H.P. General Electric Synchronous Motor, 3 ph., 25 cy., 11,500/6600/2200 V., 375 RPM

500 H.P. Allis-Chalmers, 3 ph., 25 cy., 440 V., 490 R.P.M., Complete.

300 H.P. G.E. Slipring, 25 cy., 3 ph., 2200 V., 500 RPM, 3 bearing; complete with controls.

225 H.P. Electric Mchy. Co. Synchronous, 3 ph., 25 cy., 2200 V., 500 R.P.M. with controls.

1—100 H.P. G.E. Synch. Motors, 3 ph., 25 cy., 220/440 V., with control equipment.

SLIPRING MOTORS

60 CYCLE, 3 PHASE, 220/440 VOLTS

H.P.	Make	Type	Frame	RPM
300	Gen. Elec.	I	Form M	1185
75	Gen. Elec.	MT	537	1800
60	Gen. Elec.	MT	353	1800
60	Gen. Elec. (2)	MT	353	720
50	West.	CW	654C	1800
50	West.	CW	644C	900
50	West.	CW	654C	1800
40	Wagner	22WB		540
40	West.	CW	748	690
40	West.	CW	748	690
40	West.	CW	748	690
30	West.	HF	8B	1745
30	Gen. Elec.	MTC		1725
25	Gen. Elec.	MT	513	1800
25	Gen. Elec.	I	M	1200
25	West.	CW	750C	575
20	West.	CW	648A	575
20	West.	CW	644C	575
20	Gen. Elec.	MT	332	545
20	West.	CW	748A	575
20	West.	CW	748A	575
20	West.	CW	748A	575
15	Gen. Elec.	I-M		1725
15	Gen. Elec.	ITC		1725
10	Gen. Elec.	MT		1725

25 CYCLE, 3 PHASE, 440 VOLTS

H.P.	Make	Type	Serial	RPM
150	Gen. Elec.	MT563Y	5056230	725
125	Gen. Elec.	I-17	4550934	360
50	Gen. Elec.	MT547	5264084	720
50	Gen. Elec.	MT353	3879210	750
50	Allis-Chal.		7923K	715
52	Gen. Elec.	ITC5013	1773223	700
40	Gen. Elec.	MT543	4817983	750
40	Gen. Elec.	MT343	3887755	750

SPECIAL

1—20 HP, Gen. Elec. Motor 230 v. DC. Type CD83 1750 RPM.

1—75 HP. Westinghouse Motor Type SK. 230 v. DC 475/950 RPM variable speed.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

IMMEDIATE DELIVERY

GUARANTEED REBUILT POWER EQUIPMENT

SYNCHRONOUS MOTORS

HP	Make	Type	Volts	Speed
1000	Wtg.		440	900
875	Wtg.		400	240
800	Al. Ch.		2300	180
750	Wtg. (2)		4000/2300	1200
650	Al. Ch.		2300	1200
450	Wtg. (2)		4000/2300	1200
400	G.E.	TS	440/2300	360
225	G.E.	ATI	240	720
200	Wtg.	HR	2200	225
190	Elec. Mhy (2)		440	720
190	Elec. Mhy (2)		220	514

SLIPRING MOTORS

HP	Make	Type	Volts	Speed
2850	Wtg.	CW	6600	450
1500	Allis Chal.	ANY	2200	485
800	Wtg.	CW	6600	443
700	Allis Chal.		440	354
600	G.E. (2)	IM	2300	1770
500	G.E. (2)	IM	2200	600
350	G.E.	IM	2200	360
350	G.E.	MT	2300	300
300	G.E.	IM	440	300
350	Allis Chal.		2300	300
300	G.E.	MT	2200	514
200	Wtg.	CW	440	870
200	G.E. (2)	IL	440	600
225	G.E.	IM	440	600
200	Howell R.	brg.	440	600
200	G.E.	IM	2200	600
200	Wtg.	CW	440	580
200	Wtg.	CW	440	345
150	Wagner	BR	440	1150
150	G.E.	MT	440	870
150	G.E.	IM	220	600
150	G.E.	IM	220	585
100	Wtg.	HF	440	230
300	G.E.	IM	440	293
130	G.E.	IM	440	700
75	Al. Chal.		2200	720
75	G.E.	MT	440	850
75	Allis Chal.	ARY	220	865

SQUIRREL CAGE

200	G.E.	IK	440	580
200	Wtg.	CS	440	580
200	Wtg.	CS	440	580
150	G.E.	IK	2200	1750
150	Wtg.	CS	2300	1175
150	Al. Ch.		440	1170
125	G.E.	IK	2200	580
100	Wtg. (2)	CS	440	1160
100	Wtg.	CS	2200	1160
100	G.E.	IK	220	1200
100	G.E.	IK	440	900
75	G.E.	IK	2200	1700
100	Wagner	3ST3BM	2200	428
75	G.E. (5)	IK	220	600
60	Allis.Chal.	AR	440	3500
60	Wagner	VRB	220	1200
60	G.E.	IK	220	900
60	G.E.	IK	220	900
60	Wtg.	CS	220	435
50	Howell	FBB	220	1725
50	Watson	KH	440	1720
50	G.E.	KT	2200	870
50	G.E.	IK	440	490

MOTOR-GENERATOR SETS

750 KW Elliott 220 v DC. 440 v syn.

500 KW GE 600 v DC 4400/2200 syn.

300 KW GE 3-unit 3-w 2200 v syn AC

225 KW Ideal 115 v DC 2200 v AC syn.

225 KW Wtg 115 v DC 2200 v AC syn.

175 KW AC 250 v DC 3/60/440 AC syn.

100 KW Wtg 125 v DC 220 v Ind AC

100 KW AC, 125 v DC 440 v syn. AC

150 KW GE 250 v DC 2200/220 syn.

150 KW GE 600 v DC 4000/2300 syn.

150 KW GE 250 v DC 2200/440 syn.

150 KW Ideal 250 v DC 3/60/440 Ind. AC

100 KW GE 125 v DC 440 v Ind AC

100 KW GE 230 v DC 440 v syn AC

100 KW GE 250 v DC 2200 v Ind. AC

90 KW GE 250 v DC 220 Ind AC

75 KW GE 125 v DC 220 syn AC

75 KW GE 125 v DC 220/440 Ind AC

75 KW GE 125 v DC 220 v AC Ind.

90 HP Wtg 110 v DC 2200 AC gen.

50 KW AC 125 v DC 2200 v Ind AC

50 KW GE 125 v DC 4000/2200 Ind AC

50 KW AC 125 v DC Ind. AC

33 KW Diehl 110 v DC 220 syn AC

FREQUENCY CHANGERS

500 KVA Westinghouse with 583 HP 3/25/2200/575/440/220 v. 750 RPM syn. motor 500 KVA 3/62½ cy. 2300/440/220 syn. gen. both machines amortisseur equipped, can be operated from 60 cy. to furnish 24 cy.

75—1½ HP Star ball bearing DC motors, 230 volts 1140 RPM, compound.

SPECIAL MOTOR

1—25/65 HP Wtg. oil well type 3/60/440 volts, 570/1160 RPM, style 88C138, with control, real bargain.

SYNCHRONOUS CONDENSERS

3 ph. 60 cy.

1000 HP Wtg. 3/60/440 volts 900 RPM

2000 HP GE ATI 3/60/11000 v. 600 RPM

ENGINES

500 KW GE MPC 250 volts DC generator, with Skinner uniflow engine.

500 HP Winton gas engine 8-cylinder overhead valve type, can furnish with AC generator.

125 hp. Waukesha gas engine, AC Gen.

165 hy. Hope gas engine, AC driven.

50 KW Waukesha gasoline engine—can be used for 550 volts DC or an AC generator furnished.

ROTARY CONVERTER

165 KW Gen. Elec. 125/250 volts DC 6 phase 60 cycle, 440 volts AC with switchgear and transformer equipment.

500 KW GE 240/275 volts DC 6 phase 60 cycle, 2200/4000Y AC, with switchgear and transformer equipment.

25 Cy. M.G's.

75 KW GE 125 v DC 3/25/440 AC 750 RPM interpole.

75 KW GE 125 V. DC 3/25/220 v 750 RPM 2-brg.

AC GENERATORS

KVA	Make	Type	Volts	Speed
187	G.E.	ATB	2300	600
175	Wtg.		2200	900
150	West Elec	S15C	230	900
125	Wtg.		2400	900
25	Cr. Wh.		240	1800
10	Cr. Wh.		240	1800
4	G.E. 1 ph	14½cy	110	860
1.2 KW	GE 1 ph	14½cy	110	860

TRANSFORMERS

2—5000 KVA 3/60/OISC 13800 pri 2300 v sec.

3—750 KVA GE 1/60/13890 pri 2200 v sec.

4—250 Wtg. 13800 to 2300/4000 v.

2—100 KVA GE 1/60 4600 to 120/240 v sec.

9—75 KVA Wtg. 1/60 3810 pri 240/122 sec.

WRITE FOR YOUR FREE COPY OF COMPLETE STOCK CATALOG

CHICAGO ELECTRIC CO.

1320 W. 22ND ST. CHICAGO, ILLINOIS

TURBOS 60 cy

1—4000 KW GE 7-stage double bucketed 60/3/6600/1800 RPM 150/200# ISP. Surface Condenser, exciter and panels.
2—3125 KVA Lynn Type GE Rigid Frame 4-stage 60/3/2300/3600 RPM. Surf. Condenser equip'd. Unique minimum log service.
1—625 KVA Wemco 10-C Parsons or NC 60/3/440/2200/3600—Jet Condenser—Surface available.
1—300 KW Wemco Single Wheel Re-entry 60-/3/240-120/250# and others 1000/2000 Kw.

TURBOS 25 cy

7500 KW GE Curtis Condensing Turbo 25/3/2300/1500 RPM, 175/200#. Surface Condenser.
6250 KW 80% PF Parsons design Multiple Expansion Parallel Flow 25/3/4000/1500 RPM, Surface Condenser equipped.
6000 KW GE Curtis 25/3/6600/1500 RPM, Jet Condenser equipped.
2—7200 KVA Wemco Impulse and Reaction Semi-Double Flow 25/3/11000/1500 RPM. Surface Condenser equipped.
3—4000 KW 80% old rated (log service record 7500 KW) Wemco Impulse and Reaction design 25/3/13200/1500 RPM. Surface Condenser equipped.
2—3500 KW Wemco 25/3/13200/1500 RPM with combined 18000 sq. ft. Surface Condenser.
2500 KW GE Curtis Mixed Pressure Condensing Turbo 25/3/2300/1500 RPM, 16# and 165/200#. Surface Condenser.
2—2000 KW Wemco 25/2/6600/1500 RPM Jet Condenser.

MOTOR GENERATORS

1—1500 KW GE MPC 60/3/4000 to: 600 volts DC.

TURBOS DC

1—500 KW GE Mixed Pressure 16 to 140# 250 volts DC. Surface Condenser 3100 sq. ft.

MERCURY ARC RECTIFIERS

500 KW BROWN BOVERI 600 V. D.C. AUTOMATIC SUB-STATION COMPLETE, INCLUDING OUTDOOR TRANSFORMER, 34,000 VOLTS, INDOOR TRANSFORMER, INSTRUMENT POTENTIAL TRANSFORMER; AND OTHERS.

FREQUENCY CHANGERS

5000 KW/7000 KVA Wemco Freque 62½/3/4150/375 RPM; 25/3/13200. Complete with all auxiliaries.

BOILERS

3—500 HP Edgemoor Steel Header—200#—Foster Super-heaters.
3—500 HP B&W Stirling Boilers 200 lb. superheater equipped.
8—500 HP Edgemoor Box Steel Header Water Tube, Superheaters and Chain Grate Stoker.
4—500 HP B&W Sterling 4 Drum, Cross Drum Bent Tube Boilers 160#, Diamond Soot Blowers, Green Chain Grate Stokers.
450, 400, and 300 HP B&W Sterling 4 Drum Water Tube Boilers 160#, Green Chain Grate Stokers, Coal and Ash System.
1—418 HP B&W Stirling Boiler 200 lb.
1—484 HP Springfield Horiz. ASME Straight Tube Longitudinal Cross Drum Boilers, 200# and others.

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt Street
New York, N. Y.

AC TURBINE UNITS

5000 KVA G.E. 2300/4000 V., Cond.
2500 KVA G.E. 2300 V.—Surface Condenser
1250 KVA (2) G.E. 2300/4000 V., with surface Condensor.
937 KVA G.E. 2300/600 V., Non-Cond.
937 KVA G.E. 2300 V., with Surface Condensor.
937 KVA A1. Chal.—Elliott, 480/240 V., cond. or mixed pressure; with Jet Condensor, etc.
780 KVA A1. Chal. 2300 V., with Surface Condensor, Rado-Air Ejectors, etc. NEW, never in service.
625 KVA Wghse, 2300 V., with Surface Condensor, etc.
625 KVA A1. Chal. 2 ph., 2400 V; Jet Condensor, etc.
625 KVA GE. 2300 V.; Bleeder; Condensor.
625 KVA A1. Chal.—Elliott, 240/480 V., Automatic Bleeder, with Jet or Surface Condensor.
625 KVA Wghse. 2400 V., with Jet Condensor, etc.
375 KVA G.E. 2300 V., non-cond.
375 KVA A1 Chal. 2 ph., 2400 V., with Jet Condensor.
375 KVA G.E. 2300 V., Bleeder, with Jet Condensor.
312 KVA Ridgeway-Elliot 480/240 V., with Jet Condensor.
150 KVA Wghse. 240/480 V., Jet Condensor.

AC ENGINE UNITS

450 KVA Wghse. 18x36 Filer Stowell Corliss
375 KVA G.E. 22x27 Erie Ball 4 V.
312 KVA Elec. Mchy. 20x24 Chuse Uniflow
312 KVA Wghse. 21x22 Skinner Uniflow
300 KVA G.E. 18x36 Murray Corliss
250 KVA G.E. 18x42 Hewes-Philips Corliss
250 KVA G.E. 17x20 Erie Ball 4 V.
200 KVA G.E. 21x22 Skinner Uniflow
200 KVA A1. Chal. 14x36 A1. Chal. Corliss
125 KVA G.E. 14x15 Skinner Uniflow
112 KVA G.E. 14x18 Erie Ball 4 V.
100 KVA G.E. 14x16 Skinner Uniflow
60 KVA G.E. 12x12 Skinner Uniflow

BOILERS (ASME)

950 HP Sterling, 275#
728 HP E.C. Vert. 200#
685 HP Sterling 200#
650 HP Babcock & Wilcox 225#
500 HP (2) Heine bent tube 160#
500 HP Murray (Heine) 200#
484 HP Springfield Cross Drum 200#
471 HP Erie City Vert. 200#
451 HP Babcock & Wilcox, 160#
420 HP Sterling, 200#
320 HP Sterling, 200#
302 HP Babcock & Wilcox, 200#
300 HP Heine 175#
295 HP (3) Sterling, 200#
290 HP Connolly, sectional header, 220#
253 HP (2) Heine, 160#—cross drum

BLEEDER TURBINE UNIT

625 KVA Allis Chalmers-Elliott 3 ph. 60 cy. 240/480 v.; automatic bleeder; with jet or surface condensor

GAS & DIESEL UNITS

1000 KVA G.E. 3 ph. 60 cy.; with Cooper Bessemer Nat. Gas. Engine
375 KVA Wghse. 3 ph. 60 cy.; Busch-Sulzer
200 KVA G.E. 3 ph. 60 cy.; Busch Sulzer Diesel.
168 KVA Ideal 3 ph. 60 cy.; Fulton 3 cyl. Diesel Engine; dir. con. exciter

OIL HEATING & PUMPING UNIT

Suitable for 1000 HP to 2500 HP in Boilers

TRANSFORMERS

5—1800 KVA G.E. 3 ph. 14,520-600 V.
1—1250 KVA G.E. 3 ph. 13,200/26400-2300 V.
3—833 KVA Wghse. 22000-2200 V.
2—687 KVA Maloney 13,800/460 V.
2—500 KVA Maloney 2200/220 V.
3—500 KVA Wghse. 22000-2200 V.
3—333 KVA G. E. 11,000/440 V.
3—300 KVA Maloney 17,500-440 V.
1—300 KVA Maloney 3 ph. 13,200/6600-220/440 V.
6—300 KVA Pittsburgh 22,000-2200/440 V.
2—250 KVA G.E. 6600/5940-2300 V.
3—250 KVA Packard 22,000-2200 V.
3—200 KVA Pitts. 25000-460 V.
4—200 KVA Wghse. 13,200-2300/4000 V.
3—200 KVA G.E. 22,000-2200/6600 V.
1—200 KVA G.E. 13,200-2300/4000 V.
5—200 KVA G.E. 13,200/26,400-2300 V.
5—200 KVA Wghse. 2200-110/220 V.
3—150 KVA Wghse. 11,000/440 V.
3—150 KVA G.E. 13,200-115/230 V.
1—150 KVA Wagner 13,860-110/220 V.
1—150 KVA G.E. 13,800-230/460 V.
3—100 KVA G.E. 13,200/2300 V.
3—100 KVA A1. Chal. 22,000/440 V.
3—100 KVA G.E. 13,200/6600/2300 V.
3—100 G.E. 13,200/460-2300/4000 V.
2—100 KVA G.E. 13,800-115/230 V.
1—100 KVA G.E. 33,000-2300/4000 V.
2—100 KVA G.E. 600-120/240 V.
2—100 KVA G.E. 6600/13,200/11,880-440-605 V.
1—100 KVA Wagner 13,860/220/110 V.
3—75 KVA Wghse. 11,000/440 V.
3—75 KVA G.E. 13,200-115/230 V.
4—50 KVA Wghse. 2200-220/440 V.
3—37½ KVA Wghse. 2300/575 V.

READY FOR SHIPMENT NOW

STEAM ENGINES

100 KW SKINNER UNAFLOW 150#. 250 R.P.M. Direct Connected to 115 Volt WEST. Generator cpd. Interpole

80 H.P. CHANDLER & TAYLOR 13 x 16 —200 R.P.M. 100# pressure

DC MOTORS

15 H.P. G.E. 900 R.P.M.

5 H.P. A.C. 1750 R.P.M.

1½ H.P. West. 740-2200 R.P.M.

1½ H.P. G.E. 820-1230 R.P.M.

GENERATORS

50 KVA West. 1200 R.P.M. A.C.

40 KW G.E. 1200 R.P.M. A.C.

45 KW Diehl Cpd. Int. 550 RPM 230 V D.C.

PUMPS

1—2100 GPM 130 ft. Head 1800 RPM

1—2300 GPM 163 ft. Head 1800 RPM

1—1750 GPM 120 ft. Head 1800 RPM

2—2500 GPM 55 ft. Head 1800 RPM

AC MOTORS

150 H.P. G.E. sq. cage 1800 R.P.M.

125 H.P. G.E. BTS 1150 R.P.M.

100 H.P. G.E. slip ring 900 R.P.M.

100 H.P. G.E. sq. cage 1800 R.P.M.

80 H.P. G.E. slip ring 1200 R.P.M.

60 H.P. G.E. slip ring 720 R.P.M.

15 H.P. G.E. Slip Ring 900 RPM

20 H.P. G.E. Sq. Cage 1200 RPM with P.B. Comp.

10 H.P. G.E. Sq. Cage 1200 RPM with P.B. Comp.

7½ H.P. G.E. Sq. Cage 1200 RPM with P.B. Comp.

5 H.P. G.E. Sq. Cage 1200 RPM

BOILERS

2—360 H.P. Water Tube Boilers

Installed 1933—Like New
APPROVED FOR 250% RATING
With Complete Pulverized Coal Fired Equipment Single Settings Including Independent Unitype Motor Driven Pulverizers

This plant includes main steam header with all piping, expansion bends and valves.
1500 H.P. closed type multi coil feedwater heater
2—Boiler feed pumps, brass fitted. All piping and fittings from feed pumps to heater and back to boilers is extra heavy brass—sizes from 2" to 5"
4—Unit Diamond soot blowers per boiler—steel breeching, coal and ash conveyors, magnetic separators.
2—Bailey boiler meters
Numerous New Parts, New Tubes, Etc. Boilers in service only 5 years, used alternately.
ONE—B & W Stirling W.T. Boiler 200# pressure complete with Harrington Stoker—New —1926

MISC.

ONE WEST Volt Regulator

50—30" Exhaust Fans

3000 Condenser Tubes 1" OD 20 Gauge Admiralty 18 ft. long like new

ONE MEAD MORRISON ⅝ yd. Caterpillar Shovel with Bucket Gas Driven 35 ft. Boom.

TRANSFORMERS — MOTORS — TURBINES — GENERATORS — STEAM ENGINES — BOILERS

HEAT AND POWER COMPANY, INC.

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---

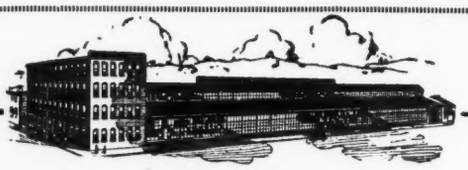
125 KVA G.E. AC Gen. driven by 6 cyl gas or nat. gas engine

NEVER USED—NEW—

200 KW—315 v. Gen. 1150 RPM DC motor: 300 HP 230 v. DC Crocker Wheeler Booster Set equal to new

A LARGE SELECTION OF UNUSUAL ITEMS

PAUL JAY ELEC. MACH. CORP.
70 Atlantic Ave. Bklyn, N. Y.



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120,000 SQ. FT. OF WAREHOUSE SPACE . .

. . . Housing our Complete Rebuilding Facilities . . . Also a wide range of Electric Motors and Power Plant Equipment

HERE'S A PARTIAL LIST OF PRODUCTS WE HAVE AVAILABLE FOR *IMMEDIATE SHIPMENT—A COMPLETE, DETAILED* LIST MAY BE FOUND IN OUR CATALOG NO. 53 *—WRITE FOR IT!*

SLIP RING MOTORS
2200 V., 3 Ph., 60 Cy.

1—60 HP, 600 RPM, General Electric, type MT-556
1—150 HP, 360 RPM, General Electric, type I-M
1—250 HP, 450 RPM, General Electric, type I-M
1—300 HP, 450 RPM, General Electric, type MT
1—300 HP, 600 RPM, General Electric, type I-M.
1—350 HP, 900 RPM, Westinghouse, type CW.

MOTOR GENERATOR SETS

3—500 KW General Electric, 600 volts, D.C., direct connected to 700 HP, 720 RPM, 2500/5000 volts, 3 phase, 60 cycles Synchroneus Motor with direct connected exciters.
1—150 KW General Electric, 250 volt, D.C., connected to 225 HP, 2200 volt, 3 phase, 60 cycle, 850 RPM, cage type motor.
1—150 K.W. Westinghouse, 250 volt, D.C., connected to 225 HP, 2200 V, 3 phase, 60 cycle, 850 RPM, cage type motor.

GAS ENGINE GENERATOR SETS

1—Foos Gas Engine, 2 cyl. vertical, direct connected to Westinghouse 62.5 KVA, 60 cycle, 3 phase, 900 RPM, 2300 volts, with exciter.
1—Foos Gas or Gasoline, 6 cylinder Vertical Engine direct connected to Western Electric, 125KVA, 220 volt, 3 phase, 60 cycle, 720 RPM, with D.C. exciter.

STEAM ENGINE GENERATORS

1—125 KW, 125 volt, 250 RPM, Westinghouse Generator connected to a 15" x 16" Skinner Automatic Engine.
1—200 KW, 125 volt, 210 RPM, General Electric, Type MP connected to a 15 & 25" x 20" Tandem compound, right hand Skinner Engine.
2—300 KW Elliott, 250 volts, D.C., 165 RPM, connected to 21x28", 4 valve Automatic Type M Engines.

THE GLOW ELECTRIC COMPANY
945 HARRIET ST. Phone MA. 3024 CINCINNATI, OHIO

ENGINES

GENERATOR SETS

DIESEL AND GASOLINE

New and Re-built

JOHN REINER & CO., INC.

12-12 37th Avenue
Long Island City, New York

Phone: Stillwell 4-4666

TURBINES

Two 500 K.W. like new condensing.
Two 500 K.W. used two years non condensing.
Current 3 ph 60 cycle 440 volt.

BOILERS

1000-750-500 all 275#.

H. A. Woodworth Engineering Co.
705 Olive St. St. Louis, Mo.

Babcock & Wilcox boilers

Two single set 500 H.P. each, 200#
One single set 400 H.P., 200#
All brick work removed, ready for immediate shipment subject to Government regulations.

HARRY BREARLEY
3423 91st Street Jackson Heights, N. Y.

AIR COMPRESSOR

1175' Ingersoll-Rand, type XCB, Air Compressor, duplex, horizontal, 35# pressure, with all equipment.

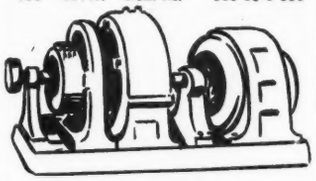
Excellent Condition

DENNY & CLARK
910 No. Marshfield Ave., Chicago,, Ill.

WAR PRODUCTION EQUIPMENT

A. C. GENERATORS

50	KVA.	F.M.	2200-60-3-1200
50	KVA.	Bullock	600-60-3-1200
75	KVA.	Gen. El.	240-60-3-900
75	KVA.	Cr. Wh.	2300-60-3-900
90	KW.	Gen. El.	2300-60-3-900
100	KW.	Gen. El.	2300-60-3-900
300	KVA.	Gen. El.	480-60-3-720
600	KVA.	Gen. El.	550-30-3-600



SYNCHRONOUS MOTORS

H.P.			Type
60	Gen. El.	ATI	4000-60-3-900
70	Burke		440-60-2-1200
75	Gen. El.	TS	440-60-3-900
95	Elec. Mach.		220-60-2-900
100	Gen. Elec.	ATI	2300-60-3-900
120	Gen. Elec.	ATI	2300-60-3-1200
125	Gen. Elec.	TS	4000-60-3-900

D. C. MOTORS

Adjustable Speed, 230 Volt

40—DC Variable Speed up to 10 H.P. All speeds and types.

H.P.			RPM
12	Westghse.	SK	600/900
15	Gen. Elec.	CD	690/1380
20	Westghse.	SK	375/1500
30	Elec. Dyn.		400/1200
30	Westghse.	SA	500/1500
50	Gen. Elec.	RF	500/1500

115 Volt

150	West.	S.	720

230 Volt

100	Gen. Elec.	CD 123	1200
150	Crocker Wh.	CCM	1200

ENGINE GENERATOR

1000 KW, 250 v. Westinghouse Engine Generator Set. Immediate Delivery. Inspection invited.

MOTOR GENERATOR SETS

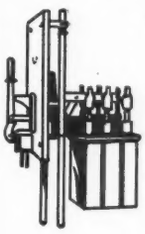
Several small units up to 20 KW. Write for quotations.

20 KW. West. 125 V.	2200-60-3
25 KW. West. 125 V.	220-60-3
40 KW. G. E. 240 V.	550-60-3
50 KW. G.E. 125 V.	440-60-3
50 KW. West. 250 V.	440-60-3
75 KW. Ridg. 125 V.	2200-60-3

CIRCUIT BREAKERS

Air and Oil

200—from 60 to 400 Amp. both Air and Oil



Amp	
	3 pole air
600	Condit
800	G. El.
1000	West.
4000	G. El.
6000	ITE
	3 pole oil
600	G. El.
800	G. El.
1200	G. El.
1500	G. El.
2000	G. El.
4000	G. El.

SPECIAL

3—250 KVA Westinghouse Inerteen (Pyranol) 60 cycle, 1 phase, 600 volt primary, 220-440 volt secondary.

1—100 KW. Westinghouse, SK, factory built. MG set. 250 volt, DC. 900 rpm. comp. Int. to 150 HP. West. syn. motor. 2300 v. 60 cy. 3 ph. 900 rpm. on base, with controls.

1—70 KVA. West. 3 bearing MG set. AC gen. 220 v. 60 cy. 1 ph. 1200 rpm. 7 pf. motor drive 125 HP. West. CS. 440 v. 60 cy. 3 ph., 900 rpm. On base.

D. C. GENERATORS

KW.			Volt	RPM
30	Gen. Elec.	DLC	125	1200
40	Westghse.	SK	250	1800
50	Gen. Elec.	DLC	125	1200
150	Crocker Wh.	CCD late	250	750

A. C. MOTORS

Sq. Cage—60 Cy.—220/440 V.

300—from ¼ H.P. to 40 H.P. All speeds and types.

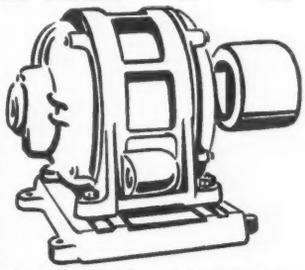
H.P.			
100	Gen. Elec.	KT	1800
100	Gen. Elec.	IK	720
125	Gen. Elec.	KT	900

550 Volt

150	Gen. Elec.	KT	1800

2200 Volt

200	Westghse.	CS	1800
200	Gen. Elec.	IK	600



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TURBO-GENERATORS

1—1200 KW Allis 600 V. Cond
1—2500 KW. G.E. 2300 V. Cond.
1— 625 KW Terry-Allis—600 V. Cond.
1— 500 KW. G.E. 240 V. Cond.
1— 500 KW. G.E. 2300 V. Mixed P.
1— 500 KW. G.E. 600 V. Cond.
1—175 H.P. G.E. Turbine—only.

AIR COMPRESSORS

1—2700 Cu. Ft.—IR—2300 V. Syn. Motor.
1—2588 Cu. Ft.—IR—Steam Driven. Cond.
1—782 Cu. Ft.—IR—55#.
1—888 Cu. Ft.—IR—2 stage Steam.
1—599 Cu. Ft.—IR—2 stage Belted
2—549 Cu. Ft.—IR—Duplex 35# pressure.
1—146 Cu. Ft.—IR—3 stage Belted 2000#

G.E. CENTRIFUGAL COMPRESSOR

Type WM—675—8800/10800.
Volume—8800/10800 Pressure 32/39.6.
Driven by 820 H.P. G.E. Turbine.
Condition excellent.

BOILERS

2—300 H.P. B&W 160#
1— 60 H.P. HRT—125#

WATER WHEEL GENERATORS

1—312 KVA. 2400 V. connected to Rodney Hunt wheel 17' Hd.
1—625 KVA. Morgan Smith 42' Hd.

BELTED GENERATOR

1—500 KW. G.E. 550 V. 225—RPM.

INDUCED DRAFT FAN

1—126,000 CFM to 210 HP Turbines.
1—165,000 CFM to 450 HP Turbine.

MOTORS

14—Motors, 25 cycle, 440-550 volts.
H.P. ranging from 15 to 350.

Also transformers, engines and cranes

Send us your inquiries

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

The Buyer Must Be Satisfied—Always

FOR SALE

7—250 H.P. Dillon self-contained Vertical boilers, Massachusetts Standard Rated at 200#.

3—500 HP 80 RPM A.C. motors with starting equipment.

1—15-ton Hand operated Traveling Crane. 100 foot runways.

Low Prices—Immediate Removal

CONSOLIDATED PRODUCTS CO. INC.

14-17 Park Row New York, N. Y.

STEAM GENERATING SET

125 KW 3 Phase, 440 Volts, direct connected to Chuse Horizontal Steam Engine, with Governor Switch Board, Exciter, etc.

SYNCHRONOUS MOTORS

2—275 hp.—600 RPM 440 Volts—7% P.F. G.E. Type ATI 3 Bearing Synchronous Motors with Starters

Reconditioned and Guaranteed

IMMEDIATE DELIVERY

PACIFIC MACHINERY CO.

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SPECIALS

865 KVA 2300 V. AC Gen. D/C Full Diesel
200 KW 2300 V. AC Gen. D/C Full Diesel
50,000 Gallon Steel Tank on 100' Tower
5200 & 2300 Cu. Ft. Air Compressors
250,000 Gallon Steel Tank on 65' Tower
12,000 Gallon Steel Storage Tanks
150 HP F-M Diesel Engine—Like New

H. & P. MACHINERY COMPANY,

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Direct Current Generators

1—40 KW C-W Type CCD. 250 v., 1100 RPM.
1—45 KW C-W Type CCD. 250 v., 1100 RPM.
1—25 KW GE Type RC 250 v., 900 RPM Generator.
1—5 KW GE Type CD 250 v. M G. Set.
1—45 KW GE Type ATB Form P.B. 550 v., 3 ph. Alternator.

MILTON WERBY & CO.

423 Atlantic Ave. Boston, Mass.

TANK ON TOWERS

25000 gal. Cap. on 68' Steel Tower.
100,000 gal. on 80' Tower.

PUMPS

2—1,000 G.P.M. Underwriters Fire Pumps.

TIDEWATER EQUIPMENT & MAC'Y CORP.

305 Madison Ave., New York, N. Y.

PROMPT SHIPMENT FROM OUR WAREHOUSE

M-G SETS 3 ph. 60 cy. (Syn.)

150 (2) KW Ridg. 275 v. DC—2200 v. AC 900 RPM
150 KW West. 550 v. DC—2200 v. AC—1200 RPM
150 KW (2) GE, 275 V. DC-2200 AC 1200 RPM.
125 KW Cr. Wh. 250 v.—440v.—AC 1200 RPM
100 KW G.E. 250 v. DC—220 v. 580 RPM
90 KW Al. Ch. 230 v. DC—2200 AC 900
75 KW West. 275 V. DC—2200 V. AC 900 RPM.

STEAM UNITS

100 KW 250 v. DC. Westgh.—Skinner Engine
1—50 KW 125 v. Al. Ch.—Ball Engine.

SYN. MOTORS 3 ph. 60 cy.

HP	Make	Volts	Speed
350	A.C.	2200	600
2-300	G.E. ATI-.88 P.F.	440	1200
225	Ideal (Unity P.F.)	440	900
2-75	G.E.	2200	900
75	Westgh.	220	1800

ELECTRIC FURNACE

3 Ton with 3—333 KVA Transformers 22000 v. 3 ph., 60 cy.

AC GENERATOR

219 KVA G.E. TRE 2400/480/240 v. 3 ph. 60 cy. 200 RPM with exc.
200 KVA G.E. Type ATB 2200/440/220, 720 RPM, 3 brg.

SLIP RING & SQ. CG. MOTORS (3 ph. 60 cy.)

HP	Make	Speed	Wdg.	Type
700	G.E.	393	S.R.	MT432
400	G.E.	1800	S.C.	
300 (2)	G.E.	1200	S.C.	
300	G.E.	600	S.R.	I-M
250	G.E.	600	S.R.	
200	Cr. Wh.	440	S.R.	28
200	Al. Ch.	600	S.C.	
200	G.E.	600	S.R.	
150	G.E.	600	S.R.	
125	Al. Ch.	435	S.R.	
125	Burke	1200	S.C.	
125	G.E.	600	S.R.	
100	G.E. 25 cy.	500	S.R.	MI-108
100	Burke	900	S.C.	
100	F.M.	600	S.C.	BB
75	West.	575	S.R.	CW868A
75	Lincoln	1800	S.C.	

DC VARIABLE MOTORS (230 VOLTS)

HP	Type	Make	Speed
100	SK	Westgh.	1400/1800
75	SK	Westgh.	475/1425
20	SK	Westgh.	900/1800
10	SK	Westgh.	600/1200
7½	SK	Westgh.	650/1300
5	SK	Westgh.	450/1800
2½	SK	Westgh.	450/1800
2	SK	Westgh.	500/1800

AIR COMPRESSORS

2200 cu. ft. 100# Chic. Pneu. Steam #9198.
550 cu. ft. 100# Bury 2 stage
160 cu. ft. Chic. Pneu. 100#
67 cu. ft. Ing. Rand ER 1 100#

SHOP HOISTS.

2—2 Ton Yale & Towne A.C. 220/3/60
7—2 Ton Sprague 230 v. or 500 v. D.C. Mono-rail.
2—4 Ton Sprague 230 v. or 500 v. D.C. Mono-rail.

5—75 HP 230 v. Generator Electric Type 211 series wound with interpoles 550 RPM.
1—40 HP 220 v. DC P&H motor 600 RPM

6—500 HP Type CS 2200 v. 3 ph. 60 cy. 500 RPM Westinghouse 3 brg.
5—350 HP Same as above.

OIL ENGINE DRIVEN AIR COMPRESSOR

Chicago Pneumatic simplate-valve Type NS03 straight line 16½" & 11" x 18" cap. 492 cu. ft. 100# pres. with air receiver and starting air compressor.

In addition to the Above We have Hundreds of Other Items in Stock—Kindly Send Us Your Inquiries

MOORHEAD-REITMEYER CO., INC., Pittsburgh, Pennsylvania

IF YOU DON'T KNOW MACHINERY—KNOW YOUR MACHINERY DEALER

FREQUENCY CHANGER

3650 HP., 3 phase, 60 cycle, 6600 volts, 300 rpm, Westgh. synchronous motor connected to a 3125 KVA 25 cycle single or 3 phase, 2300 volt synchronous motor, serial numbers above 8 million can be operated eitherway.

TURBO GENERATORS

1—937 KVA, 750 KW, 3 ph., 60 cy., 2300 V., 3600 rpm Gen. Elec. complete with C. H. Wheeler surface condenser pumps, radiojet.

1—625 KVA, 500 KW, 3 ph., 60 cy., 480 V., 3600 rpm, Gen. Elec. with direct connected exciter.

1—same in 2300 volts.

GAS ENGINE UNIT

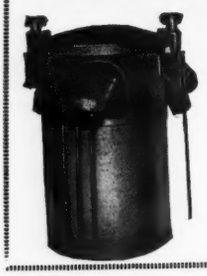
1—140 KVA, 98 KW, .7 P.F., 60 cy., 277 rpm, Gen. Elec. with direct connected exciter to 4 cylinder Foos engine. Has gasoline attachment.

The above are just a few of the thousands of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, Transformers, Circuit Breakers, etc. Please send us your inquiries. What have you for sale?

George Sachsenmaier Co.

8403 Hegerman St. Phila., Pa.

-TRANSFORMERS-



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in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR

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"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

1000 H. P. DIESEL GENERATOR SET

8 cylinder Fulton, 225 rpm, four cycle, air injection, 865 KVA, 3-60-2300 volt. Direct connected exciter, water pumps, auxiliary compressor, switchboard, and voltage regulator. A complete, fine unit. Operated 30 months. Immediately available.

ALSO OTHER DESIRABLE ITEMS:

260 HP, 200/225 lb. Connelly Boiler. ASME.
2—250 HP Heine, 150 lb. Steam Boilers.
100 and 180 HP Fairbanks Morse Diesels.

MISSISSIPPI VALLEY EQUIPMENT CO.

507 LOCUST ST. ST. LOUIS, MO.
TRY US!

ENGINE GENERATOR SET

1—312 KVA West. 3/60/2300 v. belt, exct. dir. con. Murray Special Corliss left hand eng. 18x30.

AIR COMPRESSORS

1—610 c. ft. I.R. St. Dr. 100# air, 150# stm.

SURFACE CONDENSERS

2—10 AD 4 pass 210 ft. Foster Wheeler over Comb. Air Circulating and Tail pump.

STEAM PUMPING ENGINES

1—Snow 6 mgd. C&FW Cr. Com. Opp. Type Conc 20-40x14¾x36, with waterwork type cond.
1—Allis-Chal. 4 mgd. cr. com. cond. Size 12x28x13x24. Fine cond.

PUMP

Worth Dup. Pump size 16x12x12, cap. 1100 gpm. heavy water wks. type.

BIRCH MANUFACTURING COMPANY

1523 Sedgwick St. Chicago, Ill.

SYNCHRONOUS CONVERTERS

500 KW West. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
200 KW Al-Ch, 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW R.W. 250 D.C. 2300/4000 A.C. 1200 RPM

SYNCH. MOTOR GENERATORS

200 KW G.E. 250 V. 2300/4000 A.C. 1200 RPM
200 KW G.E. 250 V. 2300 A.C. 720 RPM
150 KW R.W. 250 V. 2300 A.C. 900 RPM
100 KW WEST. 250 V. 2300 A.C. 900 RPM

IND. MOTOR GENERATORS

300 KW G.E. 250 V. 440 A.C. 720 RPM
200 KW G.E. 250 V. 440 A.C. 720 RPM

Each unit listed above is owned by us and is Available now for immediate purchase.

WALLACE E. KIRK CO.

Incorporated
502 Grant Building Pittsburgh, Pa.

TRANSFORMERS

A new Lot of Reconditioned Transformers acquired—200KVA and down. Let us have your inquiries.

Electric Apparatus Repair Co.
Specialists on Rebuilding Motors, Generators and Controls
1410 No. 6th St., PHILA., PA.

IMMEDIATE DELIVERY

3—G.E. Type H, 200 KVA, 1 ph., 60 cy., 22000 pri. 2300/4000Y sec., transformers with taps and oil.
3—G.E. Type H, 37.5 KVA, 1 ph., 60 cycle, 23000 pri, 115/230 volt sec.
Several hundred 550 volt, 3 ph., 60 cycle AC motors.
We have large stock all kinds equipment Send us your inquiries.

JACKSON-BAYLEY ELECTRIC CO.

CANTON OHIO

WE SELL — PURCHASE — RENT

Power & Dist. Transf. from one to 5000 KVA. Any Volt or Frequency.

Motors, Generators, Turbines, Centrifugal Pumps, etc.

A.C. & D.C. Elec'l Meters, Potential & Current Transf. All Makes. Scales Calibrated to your requirements.

Catalog & Prices on Request

PHILADELPHIA TRANSFORMER COMPANY

2829 Cedar St. Phila., Pa.

FOR IMMEDIATE DELIVERY

6—315 H.P., HEINE WATER TUBE BOILERS, A. S. M. E. with Breechings, Stokers, Forced Draft Equipment, Boiler Feed Pumps, Feed Water Heater, Coal Crusher, and Hopper.
2—600 K.W., 240 Volt, 2500 Amp. CROCKER WHEELER Interpole D.C. Generators each direct connected to 14" x 18" VERTICAL 4 CYLINDER AMES UNIFLOW ENGINE Speed 300 R.P.M.

ARCHER & BALDWIN, INC.

75 WEST STREET NEW YORK, N. Y.
Tel. BOwling Green 9-9275—9-9276

SEARCHLIGHT SECTION

SLIP RING MOTORS, 3 PH., 60-CY.

HP	Volts	Make	Speed
500	2300	Whse.	450
350	220–440	G.E.	1800
350	2200	G.E.	600
300	2300–4000	G.E.	1200
250	440–550	G.E.	600
200	2200–550	G.E.	1800
200	2200–440	G.E.	600
150	440–220	G.E.	1800
150	2200	G.E.	900
150	2200–440	Whse.	1800
150	550–2200	G.E.	1800
100	550–2200	G.E.	720
100	220–440	G.E.	720
100	220–440	G.E.	900
80	220–440	G.E.-MTC	900
75	440–220	G.E.	900
75	220–440	G.E.	600

SYNCHRONOUS MOTORS, 3-PH., 60-CY.

400	440–220	Whse.	76
350	440–220	G.E.	200
240	2300–440–220	G.E.	600
200	2300–4000	G.E.	1200
150	2200	G.E.	1800
100	440–220	G.E.	1200
50	220–440	G.E.	1200

TRANSFORMERS—60 CYCLE

3—400 kva., G.E. type H, 13200-440.
3—250 kva., Al. Chal. 4150-480.
3—667 Kva. Whse. 22000-2300.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—500 Kva. Whse. 22000-2300.
2—150 kva., Whse. 4800/4156/2400-480/240.
3—100 kva., G.E. type H 2400-240/480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
2— 75 kva., G.E., type HK, 2300-230/115.
3—250 Kva. Whse. 13,800-460.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse. type SK, 13800-240/120.
3—37½ kva., G.E., type H-K 2200-460.
3—37½ kva., G.E., type H-K, 2300-230/115.
3— 25 kva., G.E. type H-K 2300-230/460.
3—100 Kva. Whse. 22,000-2300.
3—50 Kva. Whse. 22,000-2300.

A. C. GENERATORS

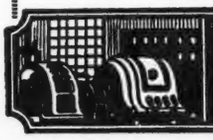
1—500 kva. 900 r.p.m. 2209 V. Whse. Condenser.
1—312 kva., 900 r.p.m., 2300-V., Westghse.
1—300 kva., 600 r.p.m., 240-480-V., G.E.
1—225 kva., 600 r.p.m., 2200-240-480-V., G.E.
1—187 kva., 900 r.p.m., 2200-550-V., Westghse.

SQUIRREL CAGE MOTORS

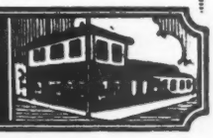
HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
500	440/220	G.E.	IK	900
400	2200	Whse.	C.S.	1800
250	2200	G.E.	IE-K	1800
250	2200	G.E.	I-K	600
200	220/440	G.E.	IK	720
150	2200	Allis Ch.	AN	450
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
50	220/440	G.E.	K	1800

MOTOR GENERATOR SETS

1—100 K.W., 250 V., 1200 R.P.M. Ridgeway, con. to 150 H.P., 2200 V., 3 ph., 60 cy., syn. motor.
1—60 K.W., 125 V., 1200 R.P.M. GE, type RC to 90 H.P., 4150/2300 V., 3 ph., 60 sy. syn.
1—25 K.W., 125 V., 1800 R.P.M., G.E., con. to KT 40 H.P., 2200/440 V., 3 ph., 60 cy. motor
1—GE, 3 unit set, consisting of 1 type RC, 10 KW, 250 V., 1750 RPM, and 1 RC, 10 KW, 125 V. Generators, coupled to KT, 35 H.P., 220/440 V., 3 ph., 60 cy., SC motor.



STEPHEN HALL & COMPANY, INC.
458 Seventh St., Hoboken, N.J.



Motor Generator Sets—Synchronous Motors, etc.

MOTOR GENERATOR SETS
3 phase, 60 cycle, A.C.

150 KW West, 275 volt DC, 2300 volt A.C.
150 KW Ridgway 275 volt D.C. 2300 volt A.C.
100 KW Ridgway 275 volt D.C. 2300 volt A.C.
100 KW West. Rotary 275 Volt D.C. 2300 Volt A.C.
50 KW Allis-Chalmers 250 V. D.C. 2200 V. A.C.

SYNCHRONOUS MOTORS
3 phase, 60 cycle

2—G.E. 700 HP 720 RPM 6600/4000/2300 Volt
Burke 300 HP 900 RPM 440/220 Volt
Ridgway 150 HP 1200 RPM 2300/440 Volt
C.W. 100 HP 900 RPM 440/220 Volt
Fairbanks-Morse 75 HP 720 RPM 220 Volt

SLIP RING MOTORS 3 phase 60 cycle

G.E. 60 HP 720 RPM 440/220 Volt
Allis-Chalm. 250 HP 600 RPM 440/220 Volt

ADJUSTABLE SPEED
220 Volt D.C. Motors

1—G.E. RF-18 90/120 HP 400/1200 RPM
1—G.E. RF-17 50/100 HP 450/1200 RPM
1—Reliance 1400-T 100/125 HP 300/900 RPM
1—West. SK-180, 100 HP 600/950 RPM
1—West. SK-180 45/90 HP 475/950 RPM
1—Diehl 60 HP 500/1500 RPM
1—Reliance 1400-T 50 HP 175/700 RPM
2—Crocker-Wheeler 125-H 50 HP 175/700 RPM
1—Allis-Chalm. 35/70 HP 450/1350 RPM
1—Allis-Chalm. 25 HP 600/1800 RPM

The Electric Motor & Repair Co., Cuyahoga Falls, O.

Immediate Shipment!

1—200 KW Westg. Syn. Motor Generator Set, 600 V. D.C., Gen., connected to 290 H.P. Synch. motor 3/60/2200 and 900 RPM, with exciters and controls

1—1000 KW Turbine type Generator, 3/60/2300 3600 RPM, Type ATB 2

4—50 H.P. G.E. Unused Slip Ring Type MTC Hoist and Crane Motors, 600 RPM, 3/60/440, type MTC 5542.

4—50 H.P. NEW Allen-Bradley Reversing Type Controllers, self-contained. 3/60/440 V.

1—50 H.P. & 1, 100 H.P. Electric Solenoid Brakes, 3/60/440.

IRON & STEEL PRODUCTS, INC.
37 YEARS' EXPERIENCE
13488 So. Brainard Ave., Chicago, Illinois
"*Anything* containing IRON or STEEL"

COMPLETE POWER PLANTS
WHAT DO YOU REQUIRE?

SPECIALS:
1—5000, 1—2500 & 1—2000 KW Turbo-Generators.
1—1500 KW Turbo-Generator Non-Condensing.
2—500 hp., 4—566 hp. & 6—600 hp. Boilers, 200 lbs.

CHARLES B. REARICK — 30 CHURCH ST., NEW YORK

FOR SALE

2—25 KVA. 2300 volt 3 phase 60 cycle General Electric alternator, will reconnect for 600, 480 or 240 volts, direct connected to General Electric 4-cylinder gasoline engines, 600 rpm.
75 KW. 125/250 volt D.C. 3-wire steam engine generating unit.
100 KW. 125 volt steam engine generating unit.

ANDREN-MYERSON CORP.
411 Atlantic Ave. Boston, Mass.

For Sale
25 CYCLE POWER PLANT EQUIPMENT

1—3000 K.W. and 2—1500 K.W. turbines, 200# steam pressure, with condensers and transformers. In A-1 condition.

B. SCHULTZ COMPANY
WATERLOO, IOWA

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1436-1438 W. RANDOLPH
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COMPLETE STOCK
ELECTRIC MOTORS
GENERATORS M-G-SETS
Rebuilt & Fully Guaranteed
ARTHUR WAGNER COMPANY
Electrical Engineers since 1906

HIGH-PRESSURE BOILERS
"New and Used — NOT Abused"!
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Phone—VanBuren 8669

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TOLEDO OHIO

OVER 10,000 ITEMS IN STOCK FOR IMMEDIATE DELIVERY FROM EITHER ROCHESTER, N. Y. OR TOLEDO, OHIO REBUILT AND SOLD WITH A STANDARD NEW GUARANTEE.

MOTORS, GENERATORS, CONTROLS, TRANSFORMERS, MOTOR GENERATOR SETS, etc.

BERGER BROTHERS ELECTRIC MOTORS INC.
395 STATE ST.
ROCHESTER NEW YORK

SEARCHLIGHT SECTION

6—600 HP Stirling boiler, with stokers, and all auxiliaries.
5—512 HP Stirling, Class S-26, 200# with stokers.
1—451 HP, 160# pressure, B.&W. sectional header.
6—600 HP B&W boilers, 200# pres. with stokers.
4—500 HP Vogt, 200 pounds pressure boilers.
1—2100 HP Badenhousen, 400 pounds pressure, with pulverizers.
3—300 HP Erie City bent tube boilers, with type E stokers 200# pressure.

1—855 HP Stirling, 275 pounds pressure.
1—25 Ton 50 ft. span three motor AC Crane, overhauled.
1—2000 HP Cocurane metering feed water heater.
2—625 KVA General Electric turbines, surface cond.
2—500 HP Stirling, 160# pressure Underfeed Stokers
1—2500 KW G.E. turbine, 400 lb. pressure, complete.
2—1250 KVA Ridgeway Condensing Turbines.
2—125 KVA Skinner (counterflow) Eng. Gen. sets.
1—250 KVA Erie Ball Corliss engine generator.

2—312 KVA Skinner uniflow engine.
1—166 KVA Ames uniflow engine generator set.
2—168 KW Vusch Sulzer full diesel engines.
1—865 KVA Fulton diesel generator set, complete.
1—450 KVA Chuse Corliss engine generator set.
1—2500 KVA Nordberg uniflow engine generator set.
5—180 HP Fairbanks-Morse Model 35, Oil Engines, new in 1935.
1—84" x 125' self-supporting steel stack.
1—3500 HP Swartwort open feedwater heater.

SEE Fletcher FIRST!

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12000' SUR. CONDENSER

With cir. pump and piping
30" Pipe Fittings, 60" Valve. Mtr. Dr.
36000 GPM 27' Head Cent. Pump
100 TO 550 HP GASOLENE ENGS. Used—New
470 GPM—Cent. Pump 693' Hd. Gas Eng. Dr.
NEW BOILER TUBES Stirling and Badenhausen
2—4166 GPM. CENT. PUMPS 162' HD.
2—100 KW—125-250 V TURBOS.
6"-12" VALVES. Ex Hy—F. & D. 12" has 2" By. P.
PRAC. NEW VALVES AND SW.BD.

Ross Power Equip. Co.
Indianapolis, Ind.

CRANES

Electric Overhead traveling cranes
20 ton motors missing 50 ft span.
20 ton Bedford 50 ft span electric.
8 ton P.H. ac current 220 volts.
Also 1¼ and ¾ yard crawler cranes

All immediate delivery.

H.A. WOODWORTH ENG'R'G. CO. 705 OLIVE ST. ST. LOUIS, MO.

FOR SALE—SHIP TOMORROW

NEW UNDERFED STOKER

Combustion type E with forced draft fan. Length 9'-4"—width 8'-6"—grate area 79.34 sq. ft.—nominal rating 356 HP 150% rating 547 HP—Inc fronts—motor drive and controls—3 phase-60 cycle—220 volts.

THOMAS C. VINCENT, JR.
420 Lexington Avenue
NEW YORK CITY, NEW YORK

ALL SIZES AND ALL TYPES

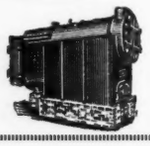
BOILERS RENTED

A.S.M.E. ALL PRESSURES

INDUSTRIAL POWER HEATING

INQUIRIES WELCOMED ALL STATES

WE BUY



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EMPIRE USED BOILER SUPPLY CO.
59 FLUSHING AVE. MAIN 4-5880 BKLYN, N. Y.

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ELECTRIC MOTORS

New and Used, Ranging In Size from ¾ to 50 h.p. Including Shaftless Motors.

SPROUT, WALDRON & CO.
169 Sherman St. Muncy, Pa.

RECONDITIONED ELECTRICAL EQUIPMENT

SYNCHRONOUS MOTORS

KVA	Make	Type	Volts	RPM	Ph.	Cy.
50	GE	ATB	220/440	1200	3	60
75	FW	VRN	220	1200	3	60
100	CW		240	900	3	60
130	GE	ATB-PB	220/440	600	3	60
150	GE	ATB-PB	2300	900	3	60
300	GE	ATB	600	600	3	60

DC 115 AND 230 VOLT

HP	Make	Type	Volts	RPM
100	GE	RC34 Comp	230	1700
125	GE	CO1832 Series	230	675
100	GE	CO1831 Series	230	675
75	GE	RC33 Comp	230	1700
50	GE	CO1810 Series	230	725
50	GE	CO1829 Series	230	750
50	WEST	K10 Series	230	475
30	GE	RC33 Comp	230	775
27	GE	HK107 Shunt	230	3600
30	WEST	SK90 Shunt	230	1700
20	CW	CMC Shunt	115	1700
20	WILSON	Shunt BB	115	1700
15	CW	CCM Shunt BB	115	850

SLIP-RING MOTORS

HP	Make	Type	Volts	RPM	Ph.	Cy.
250	AC		220	600	3	60
200	GE	1M	440	600	3	60
150	GE	1M	2200	720	3	60
150	GE	1M	440	600	3	60
75	GE	MT547	220	1200	3	60
75	GE	MT343	220	1700	3	60
75	GE	MT343	440	1200	3	60
60	IDEAL	AVA351	440	600	3	60
50	GE	MT552	440	600	3	60

SQUIRREL CAGE MOTORS

HP	Make	Type	Volts	RPM	Ph.
200	GE	1K	440	900	3
200	GE	1K	440	600	3
150	GE	1K	220	600	3
150	GE	1K	550	720	3
150	CW		2200	600	3
125	CW		2200	600	3
100	CW		2200	900	3
100	GE	1K	440	360	3
75	GE	KT543	550	1200	3
75	GE	1K	440	360	3

All Equipt Listed Available for Delivery on Short Notice. Write for Our List of Crane & Hoist Motors

Benjamin's for Motors, Inc.

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STOKER

One Type E BITUMINOUS STOKER, 81¼ sq. ft. GRATE AREA. EXCELLENT CONDITION, USED ONLY A FEW MONTHS—COMPLETE LESS MOTOR.

SPRINGFIELD GAS LIGHT COMPANY
Purchasing Department Springfield, Mass.

BOILERS

Two Heinie 250 h.p. 180# code construction. Individual settings. All trimmings, two Duplex pumps, feed water heater, breeching, main steam valves, and header pipe.

C. E. HOOTMAN
705 Olive St. Louis, Mo.

12000 FT. SUR. CONDENSER

12" 0" Top opening—7" high x -14'-6" long. 13'-3½" wide—24" circulating water con.—12" hot water con. 24" Free exhaust—1" OD-Tubes.

FS-294, Power
520 No. Michigan Ave., Chicago, Ill.

De Laval Turbine

60 H.P. geared 4000—900 R.P.M. nozzled 125# Pres., 5# to 55# B.P. arranged for belt drive and 40/50 K.W. Generator A.C. or D.C. as desired—Fine condition—will sell with or w/o generator—ideal where processing steam required.

KEATING EQUIPMENT COMPANY
50 Church St. New York City

FOR SALE BY OWNER

ROTARY CONVERTER

1—3500 KW, G.E. Synchronous Booster type 250/310 volts D.C. with a 3800 KVA, 6600/10,900/12000 volts 3 phase, rotary converter type transformer.

TURBINES

2—400 HP used for three years, good for 125 to 165 lbs. and 7 lbs. back pressure.

TURBO GENERATOR

1—350 KW West. 2300 volt. Non-condensing.
1—3000-500 KW West. Condensing 2300 V & 400 V.

BOILERS

2—250-300# steel encased
2—200 HP. B & W A.S.M.E.
3—520 HP. B & W Superheaters.
5—604 HP Babcock & Wilcox 200 lbs. working pressure.

We specialize in high pressure boiler fittings, Boiler-Supports Superheaters pop safety valves, blow-off valves, steel headers, steam valves up to 600 lbs. up to 24" in diameter, turbine and motor driven boiler feed boilers—high and low pressure pumps.

We make up AC. and DC. switchboards.

Also have in stock oil circuit breakers up to 3,000 amps. and 74,000 volts—disconnect switches up to 6000 amps.

Stock of 5,000 current and potential transformers of all sizes, all kinds of relays, overload, underload, heat element, etc.

We also buy complete plants outright. What have you for sale?

HOWE BROTHERS

324-328 Pearl Street New York, N. Y.

Telephone Nos. Worth 2-2708—2709—2710.

BOILERS

NEW and USED!

All makes & sizes for prompt shipments

1—525 H.P. 200# Springfield Cross Drum Boiler.
4—500 H.P. Stirling 160#.
3—300 H.P. B. & W. 160#.
18—500 H. P. Edge Moor 160#.

J. F. DAVIS CO.

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ENGINE-GENERATOR UNITS

150 K.W. General Electric, type AQB, form E, class 32-150-225, 2-phase, 60 cycle, 220 volts, 341 amps, direct connected to 17" x 16" Ames Horizontal Automatic Engine, 125# pressure. Complete with Panel Board, etc.

75 K.W. Burke, three-wire direct current, type W.B. 55, volts; 2x120 and 2x125, 300 amps. 275 RPM., direct connected to 13" x 16" Harrisburg Unaflow Engine. Rated 120 H.P. at 125# pressure at 275 RPM., 5# back pressure .

MOTOR

206 H.P. General Electric slip ring, type MT-12-206M, three phase, 60 cycle, 2300 volts, form M, 58 amps, 580 RPM.

M. J. HUNT'S SONS

1620-28 N. Delaware Avenue,
Philadelphia, Pa.

DIESEL ENGINES
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One of the Largest Used Stocks in the East. Send us your offerings and inquiries.

ALJON ELECTRIC DIESEL CO.

151-5 Washington St. B'klyn, N. Y.
Main 4-3804-5

FOR SALE

100 K.W. Engine Generator Set

100 K.W. 2300 volt, 60 cycle, 3 phase alternator direct connected to 11" x 18" x 15" Tandem Compound Center Crank Skinner Engine, designed to operate on 150 lbs. steam pressure, non condensing. 7½ K.W. Exciter included.

For further information address
TIP H. ALLEN, Supt.
CANTON MUNICIPAL UTILITIES
P. O. Box 114 Canton, Miss.

SPECIALS!

POWER PLANT:

2—Allis Chalmers—Kerr Turbo Generators, 500 KW, 3 phase, 60 cycle, 480 volt, equipped with Westinghouse-Blanc Jet Condensers. Turbine can be operated condensing or non-condensing at back pressure of 10-15 lbs. Complete with switchboard and exciter.

2—Heine Type 357 HP, 2 drum O'Brien Boilers, with Laclede Christie chain grate automatic stokers, with automatic coal weighing devices, individual draft equipment, feed water heater, built for 175 lb. pressure. Extra fire brick available, also extra new tubes.

* * * *

1—Farrar and Treft 150 HP Bison 2 Pass Self-contained Boiler, with Detroit Low Stoker, and Stack, for 125 lb. pressure. Built in 1941. Used 6 months. (New York State).

* * * *

GENERATORS:

1—Westinghouse Electrolytic Generator, 2000 amps., 200/40 volt, 650 RPM, belt driven, 3 pedestal.

1—Allis Chalmers Electrolytic Generator, 1250 amps., 40/120 volt, 475 RPM, belt driven.

1—Allis Chalmers Electrolytic Generator, 833 amps., 40/120 volt, 650 RPM, belt driven.

PUMPS:

1—Hill 6" double suction Centrifugal Pump, 720 GPM, 110' head.

1—Swaby 6" Centrifugal Pump.

1—Swaby 8" Centrifugal Pump.

1—Alberger Vacuum Pump, steam driven, 8" x 16"x 12".

COMPRESSOR:

1—Laidlaw Dunn Gordon two stage, steam driven Compressor, 100 lb. pressure, 1300 CFM.

WATER FILTRATION PLANT:

1—N. Y. Continental Jewell Water Filtration Plant, capacity 500 gpm, at 60 lb. working pressure.

PRESSURE BLOWERS:

2—Connorsville and Root Type SH Pressure Blowers, 24" suction, and discharge, 57 and 65 cf capacity.

ELECTRIC HOISTS:

2—1000 lb. DC Shepard Electric Hoists, 14' lift.

1—Howe 100 ton Railroad Track Scale.

Partial List only.
Send for bulletin.

BRILL Equipment Corp.
183 VARICK STREET NEW YORK

Re-built Motors and Generators

2—75 HP, 2200 V, **Fairbanks Morse**, 1800 RPM, 3 PH, 60 CY slip ring motor, direct connected to 500 GPM 3 stage 300' head pump.

1—400 HP **Westinghouse**, type CW, 3 PH, 60 CY, 440 V, 450 RPM slip ring motor.

3—350 HP **Allis Chalmers**, 3 PH, 60 CY 440 V, 600 RPM slip ring.

1—300 HP **Allis Chalmers**, 3 PH, 25 CY, 440 V, 485 RPM slip ring.

2—250 HP **Westinghouse**, type CS1012, 3 PH, 60 CY, 440 V, 435 RPM sq. cage.

1—200 HP **Westinghouse** syn. 1 PF, 3 PH, 60 CY, 2200 V 600 RPM with direct connected exciter, 3 or 2 bearing.

2—150 HP **Allis Chalmers**, 3 PH, 60 CY, 440 V, 450 RPM slip ring.

2—150 HP **Westinghouse**, type CW, frame 1000, 2 PH, 60 CY, 440 V, 450 RPM slip ring.

2—100 HP **Westinghouse**, type CS, frame 754 C, 3 PH, 60 CY, 440 V, 870 RPM sq. cage.

3—150 HP **Allis Chalmers**, 3 PH, 60 CY, 440 V, 1750 RPM sq. cage.

1—100 HP **Westinghouse**, type CCL, 3 PH, 60 CY, 2200 V, 1750 RPM sq. cage.

1—100 HP **Wagner**, type 26V5BP, 3 PH, 60 CY, 440 V, 860 RPM sq. cage

2—100 HP **Allis Chalmers**, type ANY, 3 PH, 60 CY, 440 V, 690 RPM slip ring.

1—100 HP **Westinghouse**, type SK, frame 160, 230 V, 1100 RPM.

1—100 HP **Allis Chalmers**, type ANY, 3 PH, 60 CY, 2200 V, 690 RPM slip ring.

1—75 HP **Allis Chalmers**, 3 PH, 60 CY, 440 V, 450 RPM slip ring.

1—75 HP **Westinghouse**, type CW, 3 PH, 60 CY, 440 V, 720 RPM slip ring, 3 or 2 bearing.

1—75 HP **Fairbanks Morse**, type H, frame 165 C, 3 PH, 60 CY, 550 V, 900 RPM sq. cage.

2—75 HP, **General Electric**, type I, 3 PH, 60 CY, 220 V, 720 RPM sq. cage.

1—75 HP, **General Electric**, type MT, frame 337, 220 V, 3-60-1745 RPM.

1—75 HP **Lincoln**, type IQ, 2 PH, 60 CY, 440 V, 600 RPM sq. cage.

1—75 HP **Finn-Weiksel (Wagner)** ty. 26VRN, 3 PH, 60 CY, 220 V, 1200 RPM syn.

1—250 HP **Crocker Wheeler**, type CCM, size 151 H, 230 V, 600 RPM, DC

3—100 HP **General Electric**, type CD, frame 123, 230 V, 1200 RPM DC

1—60 HP **General Electric**, type CD, frame 125, 230 V, 850 RPM, DC

1—50 HP **Westinghouse**, type SK, frame 160, 230 V, DC, 565 RPM

1—50 HP **General Electric**, Class 6, Form B, 600 V, DC, 600 RPM

1—50 HP **Ideal**, type SMS, 3 PH, 60 CY, 220 V, 1800 RPM, synchronous.

1—60 HP **Westinghouse**, type SK, frame 160, 230 V, DC, 680 RPM

1—60 HP **C&C**, 230 V, DC, 250/1000 RPM

1—75 HP **General Electric**, type CD, frame 176, 550 V, DC, 250/1000 RPM

3—75 HP **Westinghouse**, type SK, frame 150, 230 V, DC, 1100 RPM

1—100 KW **General Electric**, type DLC, 125 V, DC, 440 V, AC M-G set.

1—60 KW **General Electric**, type DLC, 150 V, DC, 220 V, AC M-G set

The Wente Electric Co.

207 N. Fourth St. Hamilton, Ohio

Est. 1903

SEARCHLIGHT SECTION

FOR SALE

Immediate Delivery

BOILERS

2—100 HP, 125 pounds working pressure, Oil Built Boilers, complete with burner, two stage electric pump, electric preheater and all controls. Burning #5 Oil. Can be inspected in service, being replaced by coal. Boilers six years old. Also one 75 HP Erie City HRT and one 70 HP Dillon HRT. Both boilers 100 pounds working pressure.

Engineering & Planning Department

Borden's Farm Products Division The Borden Co.

110 Hudson Street New York, N. Y.

SYNCHRONOUS MOTORS

1—75 H.P. General Electric 3 ph., 60 cy., 220 vo., 720 RPM.

1—100 H.P. General Electric 3 ph., 60 cy., 220 vo., 720 RPM.

Above Motors complete with D.C. Exciters, Bases, Pulleys, Compensators and Automatic Starting Panels.

In Stock—Immediate Delivery

DELTA EQUIPMENT CO.

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SQUIRREL CAGE MOTORS & DC

3 phase, 60 cycle, 230/400 volts

2— 50 H.P.	CS	900 RPM
4— 50 H.P.	KT	1800 RPM
2— 50 H.P.	CS	1200 RPM
2— 50 H.P.	KT	1200 RPM
2— 60 H.P.	KT	3600 RPM
2— 60 H.P.	KT	1800 RPM
1— 60 H.P.	KT	900 RPM
1— 50 H.P.	I—K	490 RPM 3 bear.
1— 50 H.P.	KT	600 RPM
1— 60 H.P.	KT	680 RPM
2— 60 H.P.	CS	3600 RPM
2— 75 H.P.	KT	1200 RPM
1— 75 H.P.	Allis	1800 RPM
1— 75 H.P.	Allis	1200 RPM
2— 75 H.P.	CS	900 RPM
1— 75 H.P.	KT	900 RPM
2— 75 H.P.	I—K	680 RPM
2— 75 H.P.	I—K	600 RPM
2— 75 H.P.	CS	600 RPM
4—100 H.P.	KT	1800 RPM
2—100 H.P.	KT	1200 RPM
2—100 H.P.	KT	910 RPM
1—100 H.P.	I—K	600 RPM
1—150 H.P.	All's	1800 RPM
1—150 H.P.	CS	1200 RPM
3—150 H.P	IEK	1200 RPM
1—150 H.P	I—K	700 RPM
1—100 H.P	KTP	1200 RPM
1—200 H.P.	CS	1750 RPM
3—200 H.P.	I—K	1750 RPM
3—200 H.P.	IE—K	1200 RPM
1—250 H.P.	CS	900 RPM
1—300 H.P.	All's	900 RPM

230 Volts Constant Speed D.C.

4— 1 H.P.	CD	1180 RPM
9— 2 H.P.	CD	1725 RPM
5— 2 H.P.	CD	1180 RPM
9— 2 H.P.	SK	850 RPM
16— 3 H.P.	SK	1150 RPM
21— 3½ H.P.	SK	850 RPM
9— 5 H.P.	SK	1750 RPM
23— 5 H.P.	SK	1150 RPM
19— 5 H.P.	SK	850 RPM
7— 7½ H.P.	SK	1750 RPM
21— 7½ H.P.	SK	1150 RPM
16— 7½ H.P.	SK	850 RPM
11—10 H.P.	SK	1750 RPM
7—10 H.P.	SK	1150 RPM
12—10 H.P.	SK	850 RPM
9—15 H.P.	SK	1150 RPM
8—15 H.P.	SK	850 RPM
4—20 H.P.	SK	1750 RPM
7—20 H.P.	SK	1150 RPM
4—20 H.P.	SK	850 RPM
4—25 H.P.	SK	1750 RPM
4—25 H.P.	SK	1150 RPM
4—25 H.P.	SK	850 RPM
2—30 H.P.	SK	1750 RPM
1—30 H.P.	SK	1150 RPM
1—30 H.F	SK	975 RPM
2—40 H.P.	SK	1750 RPM
2—40 H.P.	SK	1150 RPM
2—50 H.P.	SK	1750 RPM
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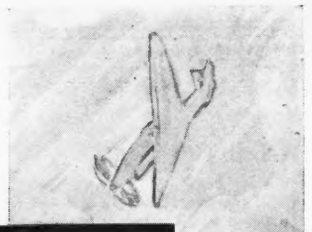
Swartwout Controls in Hundreds of Busy Plants

are Veterans of Many Years' Service without Replacement or Repairs



NOW, when *continuous production* is the chief concern of American Industry, the value of trouble-free low-maintenance controls in your power plant and steam conditioning system is doubly appreciated.

There are dozens of remarkable histories of Swartwout Controls withstanding severe punishment — for four, seven, eleven years, *and more*—without replacement and with only minor adjustments and maintenance.

Performance of Swartwout Steam Power Controls has proved time and again the sound engineering and painstaking manufacturing methods employed by this 38-old company.

For plant extension now or modernization later . . . remember Swartwout for Standard or Special Controls, with unusual safety features frequently found possible in your hook-up by Swartwout engineers.

THE SWARTWOUT COMPANY
18501 Euclid Avenue • Cleveland, Ohio

SWARTWOUT
Power Plant Equipment

- Feed Water Regulators
- Pump Governors
- Liquid Level Controls
- Pressure Control Valves
- Desuperheaters
- Desuperheater Governors
- Differential Pressure Master Regulators
- Feed Water Heaters
- Drainage Systems
- Steam Separators
- Air Separators
- Exhaust Heads

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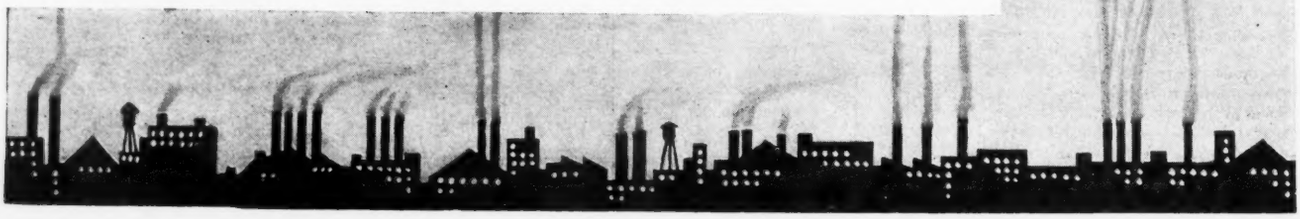
UNIT RESPONSIBILITY
Swartwout handles the complete problem of Feed Water Control or of Reducing and Desuperheating, assuring fully satisfactory results.

Swartwout

•Power Plant Equipment•



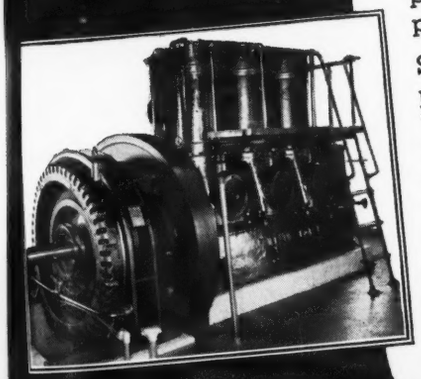
Unfailing Power Forges Speedier Victory

Continuous operation . . . no breakdowns . . . 13% saving in lubricant cost . . . with

SOLNUS OILS

Massive forgings for fighting ships . . . smaller forgings for arms for America and the uninterrupted production of them depend on the "power heart" of this forging plant — the diesel engines.

Seven large diesel engines supply the power to speed this victory production. Three of them have been in operation for 16 years on a 24 hour basis and lubricated with Sun Diesel Oils. Today these same engines are operating with original cylinders, the walls of which have never been rebored and there has never been a breakdown due to faulty lubrication. That's a typical record set with Sun Solnus Oils — the modern diesel lubricants developed to give long hours of uninterrupted operation.



Long liner life . . . no hard carbon . . . freedom from stuck rings . . . economical operation, that's what Sun Oil Engineers — those Doctors of Industry — are proving can be achieved. These skilled technical men are ready, willing and able to help you step-up the operating efficiency of your diesels and the products they have to offer have been developed to maintain that improved efficiency. For proof of what Sun Service can accomplish write for "Helping Industry Help America."

SUN OIL COMPANY • Philadelphia

Sponsors of the Sunoco News Voice of the Air — Lowell Thomas

SUNOCO

SUN PETROLEUM PRODUCTS.. HELPING INDUSTRY HELP AMERICA

Nothing Can Stop It

But the failure of a single electric motor might have made it late

Tanks are crushing, lumbering masses of many steels specialized by selective evolution to stop projectiles, to withstand wrenching jolts, to resist wear, to sustain their own great weight. Steels of many formulas, alloys of many metals, products of many factories fall magically into place in the final tank assembly . . . a magic of motor-driven machines, each turning out its allotted part with unfailing regularity in the unending days and nights of production for victory.

The failure of a single motor could halt the flow of tanks from an assembly line as surely as a shutdown of the entire factory. And it is the business of Cutler-Hammer Motor Control to see that no single motor or no battery of motors fails or falls short in its allotted task. The vital role that Cutler-Hammer Motor Control plays in the drive for victory is written around a dependability proved and known in every quarter of the globe. CUTLER-HAMMER, Inc., 1358 St. Paul Avenue, Milwaukee, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto.

CUTLER-HAMMER
MOTOR CONTROL
C-H

1892–1942
50th ANNIVERSARY

Where dependable motor control serves and saves ★

★ ***Motor driven*** equipment mined and quarried the iron ore, limestone, coal and other minerals that go into making iron and steel.

★ ***Motor driven*** conveyors and skip hoists charged the blast furnaces.

★ ***Motor driven*** blowers gave the blast furnace its blast for proper combustion.

★ ***Motor driven*** cranes carried the molten iron to open-hearth and electric furnaces.

★ ***Motor driven*** charging machines charged dolomite, ferro-manganese, raw ore and alloying metals to bring steel up to analysis.

★ ***Motor driven*** cranes carried ingots to and from soaking pits.

★ ***Motor driven*** rolling mills shaped billets and blooms and required shapes and sizes from ingots.

★ ***Motor driven*** shears and saws cut rolled steel to size.

★ ***Motor driven*** straighteners trued the plates.

★ ***Motor driven*** pre-heating furnaces brought the steel up to forging temperatures.

★ ***Motor driven*** forges shaped and toughened the steel.

★ ***Motor driven*** normalizing furnaces equalized the stresses set up by forging.

★ ***Motor driven*** metal working machines finished the steel for assembling.

★ ***Electrically powered*** welding equipment formed the tank structure.

★ ***Motor driven*** machines of many kinds completed the tank assembly.

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